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ABSTRACT

This publication is designed to provide a core of instruction for the many different fields in agricultural/horticultural education. This course contains 21 instructional units that cover the following topics: introduction to horticulture; beginning a career in horticulture; hand and power tools; introduction to safety; growing facilities; greenhouse watering; plant growth and responses; introduction to floral design; introduction to deciduous plants; chemical safety; introduction to plant growth media; elementary study of soils; introduction to fertilizers; plant propagation; introduction to indoor plants; repotting greenhouse and indoor plants; introduction to evergreens; introduction to transplanting; introduction to pruning; introduction to fruits and vegetables; and introduction to garden flowers. Each instructional unit follows a standard format that includes some or all of these basic components: performance objectives, suggested activities for teachers and students, information sheets, supplements, transparency masters, activity sheets, assignment sheets, job sheets, practical tests, written tests, and answers to assignment sheets, activity sheets, and written tests. Units are illustrated with drawings and photographs. (KC)

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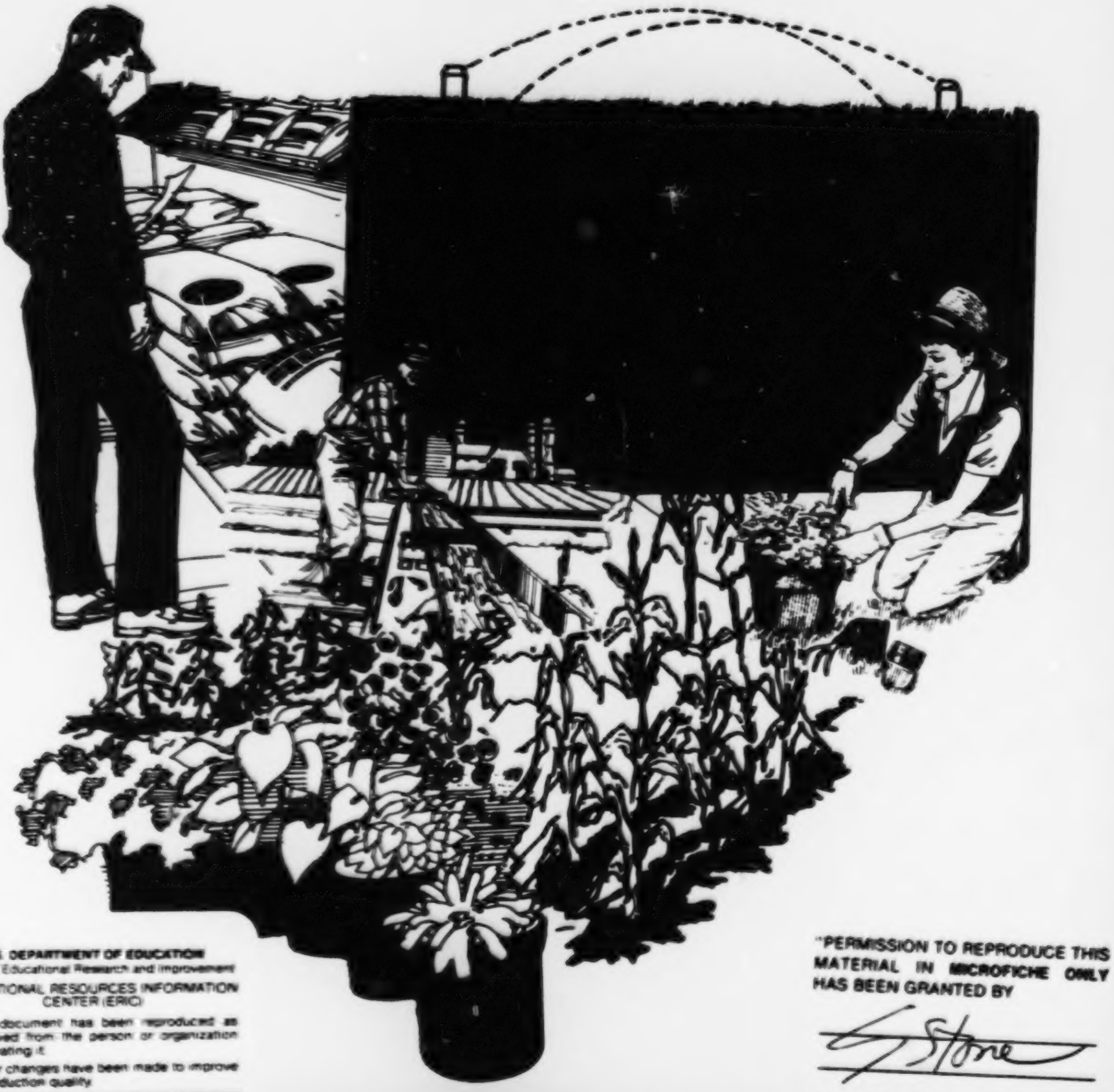
# HORTICULTURE SERIES

**TEACHER EDITION**

# INTRODUCTION TO HORTICULTURE



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Oklahoma State Department of
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Stillwater, Oklahoma

# INTRODUCTION TO HORTICULTURE

**Developed by**
**Curriculum and Instructional Materials Center**
**for the division of Agricultural Education**
**Oklahoma State Department of Vocational and**
**Technical Education**

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AG1008

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# FOREWORD

Change is constant and so must be the process of improving and updating instructional materials for Oklahoma horticulture programs. *Introduction to Horticulture* is designed to provide a core of instruction for the many different fields in agricultural/horticulture education. These many fields demand well-educated students who possess the information and skills needed for employment. During the task analysis of this publication, competencies needed for more than one horticulture occupation were identified and included in this publication. Future development in this series will include: Arboriculture, Landscape Management, Fruit and Nut Production, Vegetable Production, Greenhouse Operation and Management, Floriculture, Interior Plantscape, and Garden Center Operations.

The concepts in *Introduction to Horticulture* have been designed to facilitate basic knowledge and skills in hand and power tools, chemical safety, classroom safety, pruning and transplanting, plant propagation, care of evergreens and deciduous plants, soils and fertilizers, indoor and greenhouse plants, fruits and vegetables, garden flowers, and floral design.

Emphasis of the basic skills provided in *Introduction to Horticulture* should encourage the student to think critically about the future and the role of each individual in it. The teacher's role in implementing the concepts in the classroom is to prepare the student for the role of Horticulturist and to be a contributing member of society. It is our belief that use of *Introduction to Horticulture* in the Oklahoma Agricultural Education classroom will benefit those students served by us.

Dr. Roy Peters, Jr., State Director
Oklahoma State Department of
Vocational and Technical Education

Mr. Edward Smith, State Supervisor
Agricultural Education
Oklahoma State Department of
Vocational and Technical Education

# PREFACE

Throughout the research and interviews for *Introduction to Horticulture*, we have met many people who truly enjoy their work. From the most basic hand seeding and transplanting operations to sophisticated computer-controlled mass plantings, marketing and sales, landscape management skills, and pleasing aesthetic designs in floral arrangements and plantscapes, horticulture is becoming an increasingly desirable field. It seems to offer that special satisfaction that comes when people make their living doing what they love to do.

These are unpredictable times—most Americans will change careers seven times during their working years. This book is designed to help meet the need for career training: It's the first step in horticulture training for students from 16 to 60—or older! Whether your interest is in working a regular job or having your business, your horticulture curriculum offers a world of possibilities and different career choices.

It is a privilege to be part of the educational process that can make this multifaceted career field available to people who like plants, like to work with their hands, and appreciate the beauty and natural order of working with living plants.

This introductory book merely hints at the tremendous advances that today's knowledge and technology have contributed to improved plant production and quality. In all areas of horticulture, the knowledge of nature's laws blended with the skills of technology should help our students become well-rounded, well-trained individuals, equipped to succeed in today's world.

The future in horticulture promises to be a fertile one, blooming with exciting discoveries that will richly nourish us with beauty, good nutrition, and economic bounty.

We look forward to seeing *you* as a part of that future.

Sandra Perky Williams, Ph.D.
Writing Contractor

Mr. Greg E. Pierce, Coordinator
Curriculum and Instructional
Materials Center

# ACKNOWLEDGEMENTS

The CIMC would like to extend a great appreciation to those individuals who played important roles in the development of *Introduction to Horticulture*. For the constant support and influential drive, a thank-you to Mr. Eddie Smith, State Supervisor for Agricultural Education. For his patience and understanding, an extended thank-you to Mr. James Yeisley, Horticulture Specialist for Agricultural Education. For their continuous support and effort, a strong appreciation is extended to Greg Pierce, Curriculum Coordinator, and Sheila Stone, Development Coordinator. A generous thank you goes to the following committee members who contributed their time, talents, and knowledge in determining the contents of this publication:

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Dr. Sandra Perky Williams was the writing contractor for *Introduction to Horticulture*. Contributing writers were Dr. Williams, Gina Lauer, John Griffin, Frances K. Griffin, and Judas Mary-Ellen Riley, Stillwater, Oklahoma; and Paula S. Stone of Soft Touch Technology, Plano, Texas. An extended thank-you goes to them for their technical writing expertise, patience, and their dedication to quality.

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Special recognition and appreciation goes to Dr. Gayle Kearns, Curriculum Development Specialist, for coordinating and facilitating this entire project.

Without the professionalism and close cooperation of this production team, this project would not have provided Oklahoma teachers with the quality curriculum materials that they have come to expect from the Oklahoma State Department of Vocational and Technical Education.

# USE OF THIS PUBLICATION

## INSTRUCTIONAL UNITS

*Introduction to Horticulture* contains twenty-one units. Each instructional unit includes some or all of the basic components of a unit of instruction: performance objectives, suggested activities for teachers and students, information sheets, supplements, transparency masters, activity sheets, assignment sheets, job sheets, practical tests, written tests, and answers to assignment sheets, activity sheets, and written tests.

Careful study of each instructional unit by the instructor will help to determine:

- The amount of material that can be covered in each class period
- The skills which must be demonstrated
  - Supplies and equipment needed
  - Amount of practice needed
  - Amount of class time needed for demonstrations
- Supplementary materials such as pamphlets, videotapes, microcomputer software programs, brochures, charts, posters, etc. that should be ordered
- Resource people that need to be contacted

**Objectives Sheet** (white pages)

Each unit of instruction is based on performance objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student. Performance objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the student performance necessary to reach the unit objective.

Because the objectives of the unit provide direction for the teaching-learning process, it is important for the instructor and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials. Each student should have a copy of the objective sheet to refer to throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit.

The objectives can also help determine teaching strategies and instructional methods. Instructors should prepare for each unit by deciding how each objective

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can best be taught, depending on individualized or class instruction. Instructors should feel free to modify, delete, or add objectives to meet the needs of the students and community. If there are changes in the objectives, the instructor should supply the additional information, assignment, job, or activity sheets and criterion-referenced test items.

**Suggested Activities** (pink pages)

The suggested activities include a guide to help instructors plan their presentation of the unit. Reading the suggested activities before teaching the unit allows time to obtain supplemental materials and audiovisuals and to contact outside resources. Instructor duties will vary according to the particular unit.

References listed in the instructor's guide are those used in the development of the unit. The instructor may use the references to supplement knowledge of the subject area or to guide students with particular interests or occupation objectives in the area covered. Suggested resources are also listed.

**Information Sheets** (green pages)

The information sheet provides "must know" content essential for meeting the objectives of the unit. The information sheet serves as an excellent guide for presenting background knowledge necessary for skill development. It also may be used for coordination activities and advisory committees.

The information sheet may include notes, cautions, or warnings. These should be discussed carefully and thoroughly. **Notes** are short verbal additions to the information sheet or procedural outline that provide nice-to-know and decision-making information. A note may tell the student what to watch for or to consider at a given step. It may explain when a step may not be applicable. Notes offer guidance that may help the student understand the process and do it more efficiently. **Cautions** are advisories that tell the student how to avoid causing minor personal injury or equipment damage. **Warnings** are advisories that tell the student how to avoid serious personal injury or death to the student, persons in the workplace, or users of the project or the procedure.

**Supplements** (green pages)

Supplements include instructions that could be used for solving a problem or reinforcing the enrichment of learning. While supplements are not tested over directly, they may be used to assist in arriving at solutions using cognitive knowledge and higher-order thinking skills. They provide additional information for understanding the topic but may not have direct application to specific objectives.

**Transparency Masters** (white pages)

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented on the information sheets. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion.

**Activity Sheets** (tan pages)

The purpose of activity sheets is to provide activities not directly in support of any one objective but which support several objectives or seek to influence the student's beliefs, attitudes, or appreciation of the study area.

Activity sheets vary greatly in their number and design from unit to unit. Some deal with the student's attitudes and beliefs. These may ask rather personal questions and are not intended for review by anyone other than the student. Some activity sheets require the student to make written or oral reports. Other activity sheets may require the student to monitor his or her beliefs or other variables over a period of time and may have application in more than one unit.

**Assignment Sheets** (tan pages)

Assignment sheets provide written exercises for instruction and practice of a specific objective. The introduction to the assignment sheet explains how the assignment sheet relates to the subject area and unit objectives and may provide instructional information or refer students to another component for such information.

Assignment sheets are intended to provide students with practice in exercising higher-order thinking skills. Often, assignment sheets will contain case studies or story problems or other situations in which the student must analyze the circumstances and determine correct responses. Assignment sheets may be given to the students for completion in class or for homework.

**Job Sheets** (blue pages)

Job sheets are another important segment of a unit of instruction. The job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychomotor skill. They describe a step-by-step procedure to complete each task or job. Diagrams, photographs, and illustrations assist students in achieving the skill.

The instructor should demonstrate the procedures outlined in each job sheet. Furthermore, the instructor needs to localize the procedure according to the equipment and supplies available in the local situation. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this vocational instruction.

**Practical Tests** (yellow pages)

The practical tests are designed to assist the instructor in the evaluation of the psychomotor activities (job sheets). The practical test provides instructors with a valid mechanism for determining a student's level of ability in performing the procedure stated on the job sheet.

**Written Tests** (yellow pages)

This component provides criterion-referenced evaluation of every objective listed in the unit of instruction. It is crucial to note that both paper-pencil and performance objectives must be evaluated.

The tests may be written or oral. It is recommended that the tests be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered.

The acceptable response on a unit test, eighty-five percent in most units, may be raised or lowered to fit the topic or students' ability levels. The percentage applies to the overall score, not to each individual question. The final unit grade should be obtained by using the "paper-pencil" score along with teacher evaluations of student demonstrations of the desired skills.

**Answers to Assignment Sheets, and Written Tests** (pink pages)

These components are designed to assist the instructor in evaluation of student performances.

## PAGE NUMBERING

Each publication for the Curriculum and Instructional Materials Center is assigned a specific abbreviation. *Introduction to Horticulture* has been abbreviated Horticulture. Each unit will be recognized by the unit number in roman numerals. Each unit in the publication begins with page 1. Each page number gives the component name, abbreviation of the book, unit number, and page number within the unit. Since CIMC publications are loose-leaf, this system of page numbering was recently adopted so that pages from different publications would not get mixed up. The page number for the objective sheet in "Hand and Power Tools," which is the third unit in the book, would look like this:

OBJECTIVE SHEET - Horticulture
III - 1

## METHODS OF DISSEMINATING MATERIAL

Material may be given out a unit or page at a time to keep the material before the students always new. Some teachers ask students to furnish a three-ring binder for the units while studying a particular unit. This is more convenient for taking the material home to study. Each unit is then placed in the large binders upon its completion. The large binders may be purchased from the CIMC. Some teachers have stored the materials by units in filing cabinets or boxes until needed for use. All the units may be given out at once if desired.

Student materials should be provided for each student for best results. They may be purchased in-state for less than a teacher can reproduce the materials, especially when the teacher's time is considered. Student materials contain everything but the test answers, answers to assignment sheets, and suggested activities. The tests are collated together at the back of the student material and should be removed and stored until needed. The student should be allowed to take their materials home at the end of the year.

## TEACHING METHODS

It is a challenge to keep students motivated. Teachers can supplement the objectives by providing the "why," personal experiences, and current information. Preparation for each unit should be determined by how each objective can best be taught. Students should become involved in preparing and planning for each unit.

## COMPETENCY PROFILES

A competency profile is available for each CIMC publication. Competency profiles document student performance. The profile contains a list of the specific job competencies that a student should achieve before leaving the training program. Profiles should be distributed to students as required.

## CORRECTIONS AND SUGGESTIONS

The Curriculum and Instructional Materials Center (CIMC) wants to provide vocational instructors and students with materials that are accurate and effective. Although the CIMC strives to maintain the highest standards of development and production, oversights occasionally do occur. If you find any errors in this or other CIMC publications, or have suggestions for improving their usefulness in vocational programs, please notify the CIMC staff. One easy way of pointing out errors is to make a photocopy of the affected page and to indicate the correction on the copy. Mail this information to the CIMC, where it will be used to correct the publication before the materials are reprinted.

To ensure that the material is updated on a timely basis, notify the CIMC of necessary corrections as soon as possible after discovering the error. Do not assume that someone else will notice the error and inform the CIMC; other users may be making the same assumption. Please send corrections and recommendations for improving this publication to the following address:

Curriculum Development Coordinator
Curriculum and Instructional Materials Center
Oklahoma State Department of Vocational and
  Technical Education
1500 West Seventh Avenue
Stillwater, Oklahoma 74074-4364

**OBJECTIVE SHEET**

## INTRODUCTION TO HORTICULTURE

## I

**INTRODUCTION**

Horticulture, the science or art of cultivating fruits, vegetables, flowers and plants, allows a wide range of career options and a variety of particular skills and responsibilities. Horticulture is a field that definitely offers "something for everyone"—from the person who maintains the golf course to the experimental botanist developing food of the future. As an industry, horticulture contributes over $25 billion yearly to the economy of the United States.

**UNIT OBJECTIVE**

After completing this unit, the student should know the fields, career areas, and values of horticulture, be able to list tasks and training requirements associated with horticulture careers, and to solve basic math problems. The student will demonstrate these competencies by completing assignment sheets and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match the branches and divisions of the horticultural tree to their definitions.
2. Describe the values of horticulture.
3. List occupational tasks associated with each horticultural specialty.
4. Arrange in order the levels of the horticultural career ladder.
5. Identify position descriptions associated with each level of the horticultural career ladder.
6. Distinguish among plant nomenclature and taxonomy terms.
7. Match standard measures to their equivalents.
8. Write the basic formulas for surface area, area of a triangle, and volume.
9. Calculate mix ratios.
10. Calculate slope ratios.

11. Solve conversion problems. (Assignment Sheet 1)
12. Solve problems using the formulas for area and volume. (Assignment Sheet 2)
13. Calculate basic mix ratios. (Assignment Sheet 3)
14. Calculate slope ratios. (Assignment Sheet 4)

**PREPARATION**

- Review unit and plan presentation.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Gather resources to show genus, species, and variety, such as seed catalogs, plant encyclopedias, horticulture and gardening magazines.
- Arrange for students a field trip to local garden centers, florists, farms, orchards, agricultural research stations, greenhouses, college or university botany or horticulture departments, botanical gardens, landscaping companies, etc.
- Invite a landscape architect, golf course grounds manager, floral designer, etc. to discuss their careers with the class. Supply guest speakers with objective sheet, information sheet, and any other pertinent material you wish them to cover.

**DELIVERY**

**Objective 1**

- Give examples of the various branches and divisions of the horticulture tree using the tree (agriculture), main branches (branches of agriculture), smaller branches (divisions of horticulture), and leaves (divisions of ornamental horticulture) metaphor as a teaching device.
- Arrange for a field trip to local garden centers, florists, farms, orchards, agricultural research stations, greenhouses, college or university botany or horticulture departments, botanical gardens, landscaping companies, etc.

- Have students complete Activity Sheet 1 to give students practice in identifying the branches and divisions of the horticultural tree.
- Distribute Supplement 1—Public Gardens and Arboretums in Oklahoma.

**Objectives 2 through 5**

- Invite a landscape architect, golf course groundskeeper, floral designer, etc., to discuss their training and careers.
- Show slides of various professions or career levels.
- Have students complete Activity Sheet 2 to interest students in Oklahoma's horticulture industry.
- Have students complete Activity Sheet 3—Determine the importance of horticultural values to support Objective 2.
- Have students complete Activity Sheet 4 to help them identify the wide range of jobs and responsibilities in the eight horticultural specialties.
- Have students complete Activity Sheet 5 to distinguish between the various levels of the horticultural career ladder and the positions associated with each level.
- Have students complete Activity Sheet 6 to help identify manual and/or educational skills associated with the horticultural careers that interest them.
- Have students complete Activity Sheet 7 to aid students in analyzing their own career requirements and to compare these to the requirements and benefits of various horticultural careers.

**Objective 6**

- Collect plant or seed catalogues, plant encyclopedias, and horticulture and gardening magazines to teach visual identification of genus, species, and variety labels.
- Provide slides of several species within one genus and several varieties within one species.
- Share with students your experience with learning to distinguish among species and varieties.
- Go over Supplement 2 to help students understand binomial naming.

- Review Supplement 3 to help students understand basic Taxonomy.
- Go over Supplement 4 to help students distinguish genus species and variety.
- Have students complete Activity Sheet 8 to distinguish among plant nomenclature and taxonomy terms

APPLICATION

**Objectives 7 through 12**

- Teach techniques for memorization to help students learn and memorize standard measures and equivalents, and area and volume formulas.
- Stress that everyone in horticulture must learn math in order to both pre-plan and do on-site calculations.
- Go over Objective 7 and have students complete Assignment Sheet 1 to learn standard measures and equivalents.
- Go over Objective 8 and have students complete Assignment Sheet 2 to understand the basic formulas for surface area, area of a triangle, and volume.
- Have students complete Assignment Sheet 3 to calculate mix ratios.
- Have students complete Assignment Sheet 4 to calculate slope ratios.

EVALUATION

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the Specific Objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching method. Adjust scope, sequence, or instructional approaches to additional lessons as required.

**SUGGESTED RESOURCES**

**Audiovisual Materials**

- *Careers in the Landscape-Horticulture Industry*. VHS, color 20 minutes, 1987, Ida Bank. Award-wining video gives a close-up view of the many opportunities offered by the landscape-horticulture industry. Features interviews with a landscape contractor, parks superintendent, sports complex maintenance director, irrigation specialist, supplier sales representative, landscape maintenance contractor. Includes resource guides and supplemental materials: student membership forms for industry associations, an industry publications list, curriculum certification criteria, internship and scholarship applications. Available by title from The Idea Bank, P.O. Box 23994, Tempe, Arizona 85285, telephone 1-800-621-1136., FAX order number (602) 921-0441.

**Publications**

- *Careers in Horticulture*. Illinois Vocational Agricultural Service, 1981. A 16-page pamphlet that answers the questions, (1) What is horticulture? (2) What are some of the careers I might consider? (3) What characteristics does a person need for a career in horticulture? (4) How much training do I need? Order No. 205X. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 432-1099, telephone (614) 292-4848.

- *Mathematics for Horticulture*. Student material, Ohio Agricultural Education Curriculum Materials Service, 1982.

  **NOTE:** Basic skills in mathematics are presented within the context of horticulture. Provides instruction in basic computational tasks performed in horticultural occupations. Sections include mathematics for garden center sales, landscape construction, greenhouses and surrounding areas, nursery, arboriculture, and landscape design. Numerous exercises and practice problems are provided.

  Order No. 9512M. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210-1099, telephone (614) 292-4848.

- *Mathematics for Horticulture*. Teacher Supplement, Ohio Agricultural Education Curriculum Materials Service, 1982.

**NOTE:** Accompanies the student manual of the same title. This supplement contains post-test evaluations (tests). Answers to the tests and exercises, problems, and "Tips" given in the Student Manual are also provided.

Order No. 9513M. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210-1099, telephone (614) 292-4848.

- *The Garden Center Worker*. Ohio Agricultural Education Curriculum Materials Service, 1979. A student reference manual dealing with orientation to the garden center, business practices, selling, plant identification, care of plants in the garden center, and other products offered for sale by garden centers. 162 pages. Order No. 9501M. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210-1099, telephone (614) 292-4848.
- *The Greenhouse Worker*. Ohio Agricultural Education Curriculum Materials Service, 1981.
- *Develop Hearing Techniques*. A unit of instruction with techniques for easier memorization. Activity sheets will help students memorize standard measures and equivalents, formulas, genus, species, and varieties. Available from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

**UNIT REFERENCES**

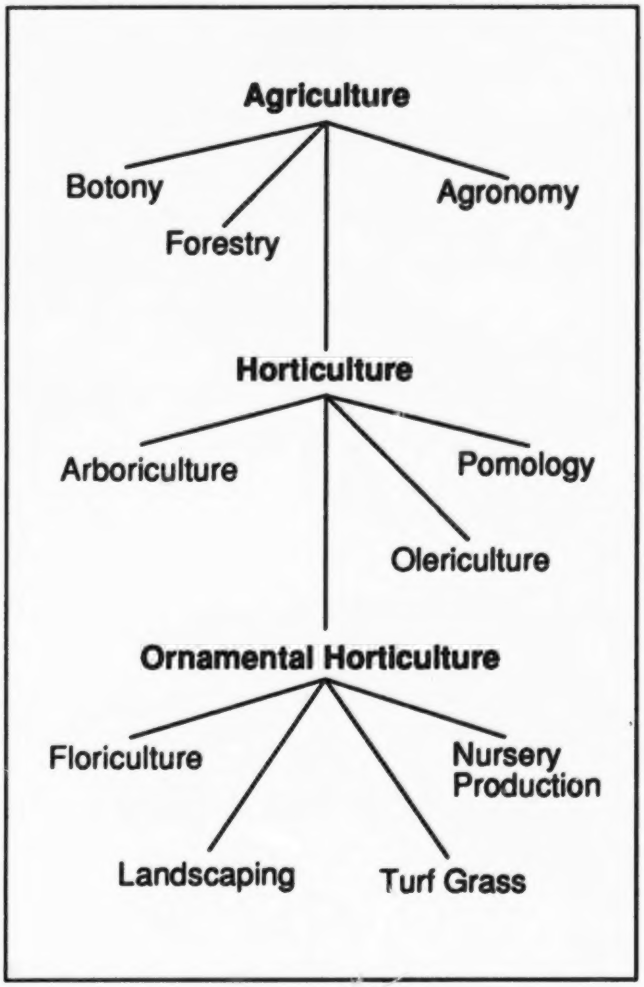
- *Horticultural Occupations*, College Station, Texas: Texas A&M University, Instructional Materials Service, 1985.
- Reiley, H. Edward & Carroll L. Shry, Jr., *Introductory Horticulture*, 3rd edition. Albany, N. Y.: Delmar, 1988.
- Richardson, William B. and Gary E. Moore. *Working in Horticulture*. New York: Gregg Division/McGraw-Hill Book Company, 1980.

**INFORMATION SHEET** | **INTRODUCTION TO HORTICULTURE** | **I**

**OBJECTIVE 1**

**Match the branches and divisions of the horticultural tree with their definitions.** (Figure 1)
(Supplement 1, Activity Sheet 1)

FIGURE 1


Agriculture
Botony
Forestry
Agronomy
Horticulture
Arboriculture
Pomology
Olericulture
Ornamental Horticulture
Floriculture
Nursery Production
Landscaping
Turf Grass

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- **Agriculture**—Science, business, and art of cultivating the soil. There are **four** main branches of agriculture which have to do with planting

- **Agronomy**—Involves the study of field crops, such as corn, wheat, alfalfa, and rice

  NOTE: Agronomy crops are grown in large areas with less intensive labor and lower costs than horticulture, which mainly focuses on grain production.

- **Botany**—Involves the study of plant life and the many elements that affect plant life

  NOTE: Botanical crops are grown primarily for research in botanical gardens.

- **Forestry**—Involves the study of the cultivation, maintenance, and development of forests

  NOTE: Forestry crops are grown on large acreages and are used primarily, but not strictly, for human resources such as lumber.

- **Horticulture**—Involves the study of growing fruits, nuts, vegetables and ornamental plants. There are **four** main branches of horticulture

- **Arboriculture**—Involves the planting, transplanting, fertilizing, pruning, bracing, disease control, and general cure of trees and shrubs

- **Olericulture**—Involves the production and care of vegetables

- **Pomology**—Involves the production, harvesting, and marketing of fruits

- **Ornamental horticulture**—Involves all the aspects related to beautifying or improving the appearance of a particular environment. Ornamental horticulture has **four** main divisions

- **Floriculture**—Involves the cultivation and sale of ornamental and flowering plants

  NOTE: Floriculture makes extensive use of greenhouses for year-round production of flowers, ornamental plants, and related products.

- **Landscaping**—Involves the planning and constructing of landscapes that will enhance and protect the beauty of the surrounding environment

- **Nursery production**—Involves the production, harvesting, and sale of ornamental trees and shrubs
- **Turf grass production**—Involves developing grasses used in athletic fields, golf courses, parks, and cemeteries

**OBJECTIVE 2** **Describe the values of horticulture.** (Activity Sheets 2 and 3)

- **Aesthetic**—Value placed on a plant's ability to beautify a given environment

  EXAMPLES: Beautiful plants are a pleasure to view.

  Indoor plants and flowers create a bright and tranquil atmosphere that lifts our spirits.

  Giving plants and flowers as gifts communicates special messages of caring.

- **Economic**—Value placed on the number of jobs and the amount of money generated by horticultural products in the community

  NOTE: The horticultural industry contributes over $25 billion yearly to the United States economy.

- **Educational**—Value placed on the study of plants as they relate to themselves, other plants, and the larger environment
- **Nutritional**—Value placed on the nutrient or food benefits received from horticultural products

The production of fruits, nuts, and vegetables is an important part of horticulture.

The horticulturist researches and develops new strains of familiar foods that are stronger, more resistant to disease, healthier, larger, tastier, and more attractive.

The horticulturist also develops completely new foods to serve our ever-increasing demands for nutrition, variety, and flavor.

- **Recreational**—Value placed on the leisure benefits received from horticultural activities and products

  EXAMPLES: Home gardening, home greenhouses, lawn care, flower arranging, home canning, herb gardening and drying, dried flowers, art projects

**OBJECTIVE 3**

**List occupational tasks associated with each horticultural specialty.** (Activity Sheet 4)

- **Arboriculture**—Identify woody plants; prune shrubs; prune trees; treat tree cavities and bark wounds; identify environmental damage to trees and shrubs; protect trees and shrubs from environmental hazards; brace and cable trees; fertilize trees; control insects and pests; control tree diseases
- **Floriculture**—Control plant environment; stores, ships, and takes inventory; service and maintain equipment and facilities; perform general office work; perform sales and sales-related duties; maintain and construct structures; manage the business; apply safety practices; design floral arrangements
- **Fruit and Nut Production**—Prepare and improve soil; propagate plants, seeds, and cuttings; maintain plants; harvest fruits and nuts; grow-crops; control plant and environment; control diseases, weeds, and pests; maintain and repair equipment and facilities; operate equipment; use irrigation systems; grade and package crops; sell products
- **Greenhouse operation**—Propagate plants, seeds, and cuttings; prepare soils and planting media; control plant environment; apply fertilizers and chemicals; harvest plants; store, ship and take inventory; service and maintain equipment and facilities; operate equipment; use irrigation systems; grade and package crops; sell products

- **Interior plantscaper**—Prepare and improve soil; propagate plants, seeds and cuttings; maintain plants; grow plants; control plant environment; control diseases, weeds, and pests; maintain and repair equipment and facilities; use irrigation system; store, ship, take inventory and maintain merchandise; sell products; design interior landscapes

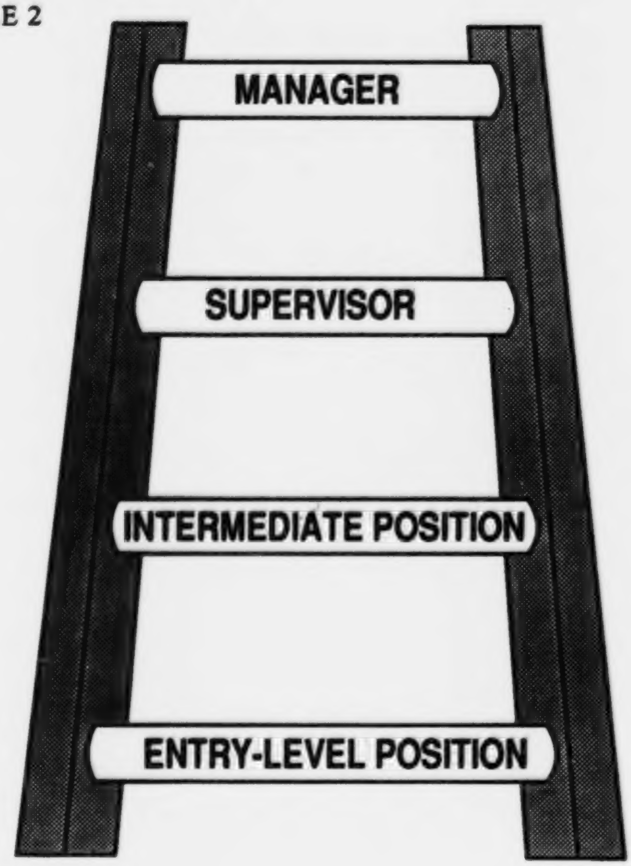
- **Landscape management**—Prepare and improve soil; propagate plants, seeds, and cuttings; maintain plants; grow plants; control plant environment; control diseases, weeds, and pests; maintain and repair equipment; use irrigation system; store, ship, take inventory and maintain merchandise; sell products; design exterior landscapes; work with architects, planners, and designers

- **Vegetable production**—Prepare land for planting; plant and transplant crops; cultivate and irrigate crops; apply fertilizers and pesticides; construct and maintain buildings and structures for storage; maintain equipment and vehicles; grow seedlings; use irrigation systems; harvest vegetable crops; grade and package crops; store and ship plants; take inventory and maintain merchandise; sell products

- **Garden center operations**—Open and close store; keep business records; prepare written and oral communications for the public; display merchandise; sell products; handle merchandise; maintain plants; prepare plants for sale; control plant environment; inspect and diagnose plant problems; maintain hand tools and equipment; maintain power equipment; design landscapes; maintain facilities

**OBJECTIVE 4** **Arrange in order the levels of the horticultural career ladder.** (Activity Sheets 5, 6, and 7)

FIGURE 2


MANAGER
SUPERVISOR
INTERMEDIATE POSITION
ENTRY-LEVEL POSITION

**OBJECTIVE 5**

**Identify position descriptions associated with each level of the horticultural career ladder.**

1. **Entry-level position:**
   - Involves on-the-job training
   - Involves a great deal of manual labor
   - Involves mechanical and technical tasks
   - Requires skills using equipment and tools
   - Requires knowledge about plants
   - Requires worker to perform well with minimum supervision
2. **Intermediate position:**
   - Attained through work experience and/or continuing education
   - Requires some business knowledge and experience
   - Requires knowledge about plant production and selling
   - Requires skills and knowledge to operate machinery and equipment
3. **Supervisory position:**
   - Requires vocational training and/or some college education, such as associate degree
   - Generally achieved through promotion
   - Requires guiding and directing employees in their work
   - Requires broad knowledge of the horticultural industry
4. **Managerial position:**
   - Requires specialized training, such as a college degree or equivalent
   - Requires experience in the horticulture industry
   - Requires skills to direct people and tasks
   - Requires the ability to make sound decisions with the information available

- Requires financial management skills
- May require long and irregular hours

**NOTE:** In small businesses, the manager is usually the owner.

**OBJECTIVE 6** **Distinguish among plant nomenclature and taxonomy terms.** (Activity Sheet 8, Supplements 2, 3, and 4)

- **Nomenclature**—System of names used in a branch of learning

  EXAMPLES: Common names and botanical names; music symbols and notes are the nomenclatures for music.

- **Taxonomy**—Science of classification

  **NOTE:** *Taxonomists* are scientists who identify and classify plants.

  Taxonomists use two systems for naming plants:

- **Common name**—Popular, familiar, or local plant name. Most plants have more than one common name; some have several

  Common names are confusing. The same plant may be known by different common names in different parts of the country.

  EXAMPLE: The Judas tree and the redbud tree are the same tree, but are known by different names in respectively, in the Eastern and Southwestern United States.

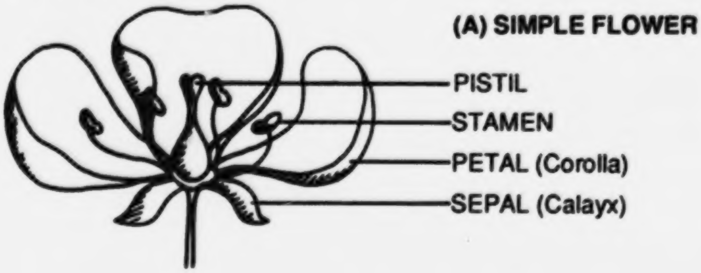
  Two different plants may have the same name.

  EXAMPLE: The cowslip is one of these in New York State, it is a buttercup-like plant that grows in marshes. However, in new England, it is a primrose-like plant that comes from dry, grassy slopes.

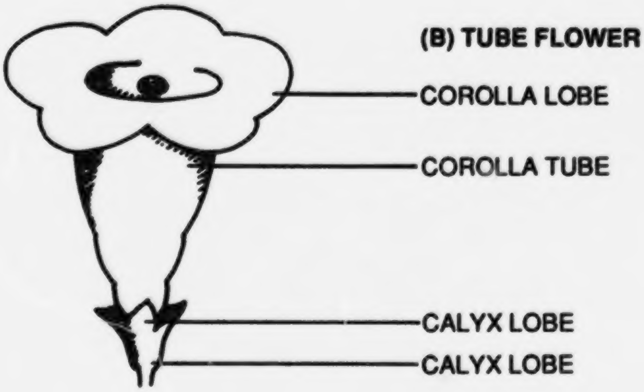
- **Binomial name**—The scientific plant name, which consists of two Latin names

- The first name is known as the **generic name**; this is the plant's group name. All plants having the same generic name belong to the same **genus** (Gee-nuss)
- Related general (plural of genus) with similar flower structure are grouped together into **families**

FIGURE 3



**(A) SIMPLE FLOWER**



**(B) TUBE FLOWER**

- The second name is the **specific name**. All plants having the same specific name belong to the same **species**

  **NOTE:** Plants of the same species have the same characteristics and will consistently produce plants of the same type.

- Today, some species are subdivided into **varieties**

  **NOTE:** One variety of a species may resemble another variety, but there are always one or two differences that are consistent and inherited. For example, the nectarine tree, *Prunus persica var nectaria*, is a variety of the peach tree, *Prunus persica*.

**Rose Family**

- Procedures for scientific naming—Because scientific names are written in Latin, a foreign language, they are written in *italics*. Certain other customs apply when expressing scientific names:
- Genus
  - Always written first
  - Begins with a capital letter
  - Usually a noun
- Species
  - Always written last
  - Begins with a lowercase letter
  - Usually an adjective

**NOTE:** When the scientific name is used, the horticulturist is able to order a plant from any part of the world; it is a universal language.

An international set of rules has been drawn up to ensure that every different species has a different binomial name and that the scientific name assigned to that plant is the oldest binomial name ever used for that plant. This international set of rules is called the *International Code of Botanical Nomenclature*.

**OBJECTIVE 7** **Match standard measures to their equivalents.**

A. **Linear measure**

12 inches (in.) = 1 foot (ft.)
3 ft. = 1 yard (yd.)
1,760 yd. = 1 mile (mi.)
5,280 = 1 mile (mi.)

B. **Surface measure**

144 sq. in. = 1 sq. ft.
9 sq. ft. = 1 sq. yd.
4,840 sq. yd. = 1 acre
640 acres = 1 sq. mi.

C. **Cubic measure**

1,728 cu. in. = 1 cu. ft.
27 cu. ft. = 1 cu. yd.

D. **Liquid measure**

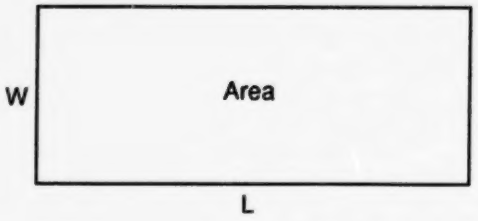
16 ounces (oz.) = 1 pint (pt.)
2 pt. = 1 quart (qt.)
4 qt. = 1 gallon (gal.)
1 gal. water = 8 1/2 pounds (lb.)
7 1/2 gal. = 1 cu. ft.
55 gal. = 1 drum (barrel)
30 gal. = 1/2 drum (1/2 barrel)

**OBJECTIVE 8** **Write the basic formulas for surface area, area of a triangle, and volume.**

A. **Surface area**—Area = Length x Width

**NOTE:** Surface area is expressed in *square* inches, feet, yards, miles, or acres.

EXAMPLE: A = L x W



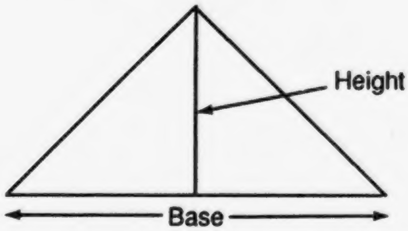
A parking lot is 200 feet long and 150 feet wide. What is the area?

A = L x W
= 200 x 150
= 30,000 sq ft

B. **Area of a triangle**—A = 1/2 the Base x Height

**NOTE:** Area is expressed in *square* inches, feet, or yards.

EXAMPLE: A = 1/2 B x H



What is the surface area of a triangular pothole 3 feet long and 6 feet across?

A = 1/2 B x H

= 1/2 (3 x 6)

= 1/2 x 18

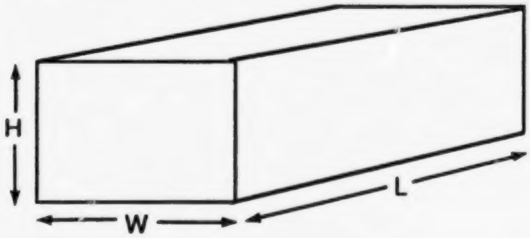
= 9 sq ft

= 1 sq yd

C. **Volume**—Volume=Length x Width x Height

**NOTE:** Volume is expressed in *cubic* inches, feet, or yards.

EXAMPLE: V = L x W x H



A raised planting bed is 10 feet long, 4 feet wide and 2 feet high. How many cubic yards of soil will it hold?

V = L x W x H

= 10 x 4 x 2

= 80 cu ft

= 80 ÷ 27 (Convert cubic feet to cubic yards.)

= 2.96 cu yd

**OBJECTIVE 9** **Calculate mix ratios.**

**NOTE:** Ratios compare only *like* quantities such as gallons to gallons, feet to feet. You cannot have a ratio of inches to feet.

1. Figure out the terms of the ratio

   **NOTE:** The order of numbers in a ratio corresponds to the order of materials or objects as stated.

   EXAMPLE: Mix vermiculite and perlite to a ratio of 2:1, OR mix perlite and vermiculite to a ratio of 1:2.

   Vermiculite—2 parts (may be cubic feet, cubic yards; 5-gal buckets, 50-pound sacks)

   Perlite—1 part (must be same kind of measurement as vermiculite)

   **NOTE:** Vermiculite and perlite are materials used in making soil mix. Peat moss is also used.

2. Reduce ratio to lowest terms for easier handling

   EXAMPLES: 3:180 = 1:60 4:12 = 1:3 75:25 = 3:1

3. Divide the given amount by the number of parts to find one part

   EXAMPLE: You have 36 cu. yd. of vermiculite, how much peat moss will you need to mix a 3:2 ratio of vermiculite and peat moss

   36 ÷ 3 = 12 (1 part)

4. Multiply that amount by the number of parts of the unknown quantity or quantities

   EXAMPLES:

   a. You have 36 cu. yd. of vermiculite, how much peat moss will you need to mix a 3:2 ratio of vermiculite and peat moss?

      36 ÷ 3 = 12 x 2 = 24 cu yd of peat moss

b. Mix peat moss and perlite to a ratio of 3:1. You have 42 cu ft of peat moss. How much perlite will you need?

42÷3 = 14 cu. ft. of perlite (1 part)

c. The ratio of perlite, vermiculite, and peat moss to make a soil mix is 2:2:3. If you have 20 cubic feet of perlite, how much vermiculite and peat moss will you need?

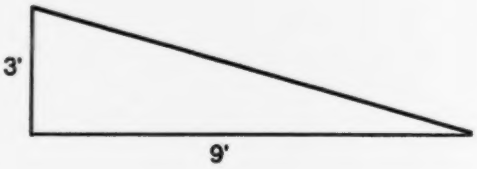
Perlite 1 part = 20 ÷ 2 = 10 cu. ft.
Vermiculite 2 parts = 2 x 10 = 20 cu. ft.
Peat moss 3 parts = 3 x 10 = 30 cu..ft.

**OBJECTIVE 10**

**Calculate slope ratios.**

**NOTE:** Slope ratio is expressed in two numbers. The first number always refers to the horizontal distance, and the second number always refers to the vertical distance.

EXAMPLE

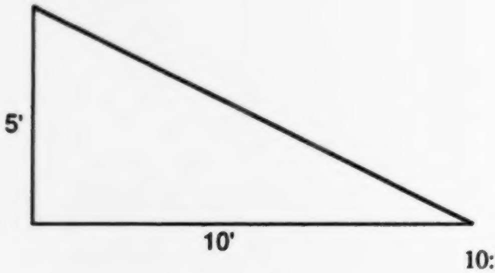


The ratio is 9:3; reduced to its lowest terms, the slope ratio is 3:1.

1. Find the slope ratio, given the vertical and horizontal distance

   a. State the ratio in feet as horizontal feet : vertical distance

   EXAMPLE:



10:5

   b. **Find the highest number which will divide evenly into both numbers; or divide the vertical distance into the horizontal distance**

      EXAMPLES:

      $10:5 = 2:1$  OR  $\frac{10}{5} = 2:1$

      $15:7 = \frac{15}{7} = 2.14:1$

   c. **Reduce answer to lowest terms**

2. **Find the vertical distance, given the slope ratio and the horizontal distance**

   a. **Divide the horizontal distance by the fist term in the ratio to find one part**

   b. **Multiply the answer by the second term in the ratio**

   EXAMPLES:

   1. **Slope ratio is 3:1; horizontal distance is 33 feet.**

      **$\frac{33}{3}$ = 11 feet ( 1 part)  11 x 1 = 11 feet vertical distance**

   2. **Slope ratio is 4:3; horizontal distance is 36 feet.**

      **$\frac{36}{4}$ = 9 feet (1 part)  9 x 3 = 27 feet vertical distance**

3. **Find the horizontal distance given the slope ratio and vertical distance**

   a. **Divide the vertical distance by the second term in the ratio to find one part**

   **NOTE: If the second term is 1, as in 3:1, leave this step out.**

   b. **Multiply the answer (or the vertical distance if the ratio is equal to 1) by the first term in ratio**

   EXAMPLES:

   1. **Slope ratio is 4:1; vertical distance is 2 feet.**

      **2 x 4 = 8 feet horizontal distance**

2. Slope ratio is 8:3; vertical distance is 6 feet.

   $\frac{6}{3}$ = 2 feet (1 part)

   8 x 2 = 16 feet horizontal distance

## PUBLIC GARDENS AND ARBORETUMS
### Oklahoma and Vicinity

Ada Arboretum
Winter-Smith Park
Scenic Drive and 18th
Ada, OK 74820
Contact: Ada Park & Recreation
Department, Ada, OK 74820
405-436-6300

Cedarvale Gardens
Rt. 1, Box 50
Davis, OK 73030
Exit 50 on I-35
Contact: Bob or Elaine Howell
405-369-3224

Cherokee Gardens
Box 520
Tahlequah, OK 74464
Contact: Robert D. Hathaway
918-456-6767

Enid Arboretum
Meadow Lake Park
Rupe and Van Buren
Enid, OK 73701
Contact: Enid Park & Recreation
Department, 405-234-0400

Bartlett Arboretum
Belle Plaine, Box 38
Kansas 67013
via I-35, exit at Wellington, Kansas
316-488-3529

OSU Extention Campus and
Horticulture Arboretum
Stillwater, OK 74078-0511
Contact: Hort. Dept.
360 Ag Hall, 405-624-5416

Tulsa Garden Center Arboretum
2435 S. Peoria Avenue
Tulsa, OK 74114
918-749-6401

Will Rogers Horticultural Gardens
3500 N.W. 36th Street
Oklahoma City, OK 73112
405-943-3977

U.S. Department of Agriculture
Experiment Station Arboretum
South 18th Street
Woodward, OK 73801
Contact: Phil Sims, 405-256-7449

J.E. Conard Municipal Rose Garden*
Honor Heights Park
Muskogee, OK 74401
Contact: Muskogee Park & Recreation
Dept., 918-682-6602 x302

Municipal Rose Garden*
Will Rogers Park
3500 N.W. 36th Street
Oklahoma City, OK 73112
405-943-3977

Tulsa Municipal Rose Garden*
Woodward Park
2435 S. Peoria
Tulsa, OK 74114
Contact: Russell Studebaker
918-747-2709

Kerr Arboretum and Conservation Center
U.S. Forest Service Headquarters
Hot Springs, AR 71901
Contact: Mr. Art Cowley
501-321-5202

Rotary Memorial Rose Garden
Wacker Park
Pauls Valley, OK 73075
Contact: Mayor's Office, City Hall
405-238-3308

## Garden Centers

Ardmore Garden Center
502 Stanley Blvd.
Ardmore, OK 73401

Bartlesville Garden Center
3502 Price Road
Bartlesville, OK 74003

Tulsa Garden Center
2435 S. Peoria
Tulsa, OK 74114

Will Rogers Garden Center
3500 N.W. 36th
Oklahoma City, OK 73112

*AARS Rose Gardens

*Source*: Paul J. Mitchell, Extension Home Horticulture specialist, OSU Cooperative Extension Service, Stillwater, OK 74078-0481

# BINOMIAL NAMING OF PLANTS

## AN INDICATION OF WHERE PLANT WAS FOUND

americana (AMERICA)
korena (KOREA)
orientalis (ORIENT)
virginious (VIRGINIA)

## NAME OF PEOPLE

baileyi
wilsoni
fortunei

## NAME MAY REFER TO SEASON

autumnale (AUTUMN)
aestivalis (SPRING)
praecox (VERY EARLY)

## DESCRIPTION OF PLANT'S FLOWER

floribundus (QUALITY)
multiflora (MANY FLOWERS)
grandiflora (SIZE)

## BASIC TAXONOMY

### PLANT KINGDOM

**KINGDOM**

1 DIVISION

2 CLASS

3 ORDER

4 FAMILY

5 GENUS

6 SPECIES

7 VARIETY

8 FORM

9 INDIVIDUAL

## GENUS, SPECIES, AND VARIETY

### BOTANICAL NAMES OF PLANTS

### SPINACH

SPINACIA OLERACEA LINNE

| | | |
|---|---|---|
| A. GENUS | ____________ | SPINACIA |
| B. SPECIES | ____________ | OLERACEA |
| C. VARIETAL NAME | ____________ | LINNE |

NAME ____________________________

## Construct a Horticultural Tree

Construct a horticultural tree that shows the various branches and divisions of horticulture. Use your own creativity to provide parts of an actual tree to indicate the various branches, divisions, and subdivisions associated with horticulture. Refer to Objective 1 in the Information Sheet.

## HORTICULTURAL OPPORTUNITIES IN YOUR AREA

Horticulture will allow you to express your skills and talents. Because of the variety of careers associated with horticulture, there are sure to be several opportunities right where you live.

## HORTICULTURE OPPORTUNITIES IN OKLAHOMA

In the 1960s, Oklahoma did not rank nationally in nursery-tree production. Today, Cherokee County, in Eastern Oklahoma, is the eleventh leading county in the nation in nursery production. Tahlequah's Greenleaf Nursery is the third largest container nursery in the United States.

Oklahoma has over 5,000 acres of field-grown nursery stock valued at $10,000 per acre. What is its cash value?

Oklahoma has over 200 acres of container-grown stock with an estimated value of $22,500 per acre. How much is it worth?

Oklahoma is one of the top pecan-producing states in the south. Pecans are the No. 1 horticulture crop in both acreage and in value. About 22,000,000 (22 million) pounds of pecans are harvested every year, with an estimated value of $7,000,000.

Apples and peaches add between $750,000 and $1,000,000 annually to the state's economy. About 15,000 acres of commercial and processed vegetables are cultivated every year, with a value of $750 to $1,000 per acre. What's the total value of fruits and vegetables to Oklahoma's economy?

Raising for processing means a crop is grown for the purpose of canning or freezing. Oklahoma ranks second out of the 13 southern states in raising spinach for processing and fifth in raising snap beans for processing.

Oklahoma has a climate and growing season that enables producers to grow a variety of horticultural crops that make a significant contribution to the state's economy. Add up all the crop values above and see just how significant this contribution is.

**Find out about the horticultural opportunities and the crops grown within a 30-mile radius of your town and list them here.**

**ACTIVITY SHEET 3**

## INTRODUCTION TO HORTICULTURE

**I**

NAME ______________________________

### DETERMINE THE IMPORTANCE OF HORTICULTURAL VALUES

**INTRODUCTION**

Horticultural careers allow a person to satisfy a variety of personal desires and to act as both an artist and a scientist.

The field of horticulture has many positive aspects; plants, trees, fruits, flowers, and vegetables enrich our lives in many ways.

As you learn more abut horticulture you will see the ways in which this career will enrich your personal life and enable you to bring value to others' lives.

**DIRECTIONS**

Interview three individuals involved in horticulture and describe how each individual views the horticultural values

EXAMPLE: A floral designer may place the most importance on the aesthetic value because the plant's appearance sells the designer's products.

NOTE: Possible sources might include florist, grocers, farmers, horticulture professors, golf course managers, etc.

**Aesthetic value:**

1. ______________________________________________

2. ______________________________________________

3. ______________________________________________

**Economic Value:**

1. ______________________________________________

2. ______________________________________________

3. ______________________________________________

**Educational Value:**

1. ______________________________

2. ______________________________

3. ______________________________

**Nutritional Value:**

1. ______________________________

2. ______________________________

3. ______________________________

**Recreational Value:**

Use this space to note information about each interview

| Interview # | Name | Co. | Position |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

## HORTICULTURE JOBS AND RESPONSIBILITIES

Horticulture offers you a wide range of jobs and responsibilities within each of its specialties.

Use the accompanying chart to consider your own career direction.

| Job Title | Floriculture | Landscaping | Nursery | Turfgrass | Pomology | Olericulture | Arboriculture |
|---|---|---|---|---|---|---|---|
| Asst./Manager<br>Manager | 1. Operating the business<br>2. Making decisions<br>3. Processing orders | 1. Operating the business<br>2. Managing equipment, personnel, and finances | 1. Making decisions cocerning plant production<br>2. Allocating task to supervisors and workers<br>3. Operating the business<br>4. Making decisions concerning finances, hiring practices, and product management | 1. Overseeing all functions of the business<br>2. Keeping daily, monthly, and weekly records<br>3. Ordering supplies and parts | 1. Making decisions on purchasing, marketing, etc.<br>2. Being knowledgeable in all areas of fruit production<br>3. Operating the business | 1. Making decisions<br>2. Possessing and demonstrating knowleidge in vegetable production<br>3. Operating the business | 1. Making decisions<br>2. Locating and securing work for the company<br>3. Hiring and firing personnel<br>4. Maintaining equipment |
| Designer | | 1. Developing plans for a landscape site<br>2. Knowing how to draw landscape plans<br>3. Choosing appropriate structures<br>4. Overseeing the construction process | | | | | |

NAME ______________________________

## CONSTRUCT A HORTICULTURE CAREER LADDER

**INTRODUCTION**

Horticulture is a career with astronomical potential. Horticultural products range from the loveliest rose in a birthday bouquet to trees in a neighborhood park, to the latest variety of tomato. Similarly, horticulture offers a variety of career duties and responsibilities; a person may climb the horticulture career ladder; moving ever upward as he or she gains experience and education.

**DIRECTIONS**

Construct a horticulture career ladder that shows each level required to achieve the position you would someday like to obtain.

Position ______________________________________

NAME ______________________________

## COMPLETE A MANUAL AND EDUCATIONAL SKILLS ASSESSMENT

**INTRODUCTION**

Becoming familiar with professionals in your chosen field will help you to determine your educational and manual skills which will assist you in the horticultural field. Researching your strength will help you to determine what skills or education you need to acquire to reach your goal.

The following jobs generally require manual skills, involving work with the hands, tools, or equipment. Work is generally performed outdoors.

Bedder
Farm chemical salesperson
Greenhouse worker
Greenskeeper
Groundskeeper
Landscape gardener
Nursery grower
Orchardist
Propagator
Pruner
Tree surgeon
Turf worker
Small fruit grower
Seeds salesperson
Vegetable crop grower

The following jobs generally require educational training, involving planning, paperwork, and personnel management. Work is generally performed indoors.

Consultant
Greenhouse manager
Landscape architect
Lab technician

Nursery manager
Office supervisor
Plant breeder
Garden center manager
Plant disease specialist
Pest control specialist
Pesticide specialist
Researcher
Sales person
Teacher

**DIRECTIONS**

Interview three people with horticultural careers that require manual skills and three people with careers that require educational skills. Describe the manual skills or educational skills of each individual. Make sure that each person you interview signs your assessment in the space provided.

| Manual Skills Required | How Skill Acquired | Position | Company | Signature |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

| Educational Skills Required | How Skill Acquired | Position | Company | Signature |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

**ACTIVITY SHEET 7**

## INTRODUCTION TO HORTICULTURE

**I**

NAME ______________________________

## COMPLETE A SELF-ANALYSIS AND ENTRY LEVEL ANALYSIS

**INTRODUCTION**

"Know yourself" is an important piece of advice. The more you know about your likes and dislikes, needs and desires, the more successful you will be at discovering a job that allows you to use all your skills and talents and to continue to grow.

**DIRECTIONS**

Analyze your career requirements and match them to entry level horticultural job requirements and benefits.

1. Write "Y" or "N" next to the appropriate questions.
   Do you want a career that involves:

| | YES | NO |
|---|---|---|
| Regular working hours? | _____ | _____ |
| Working indoors? | _____ | _____ |
| Working outdoors? | _____ | _____ |
| Year round work? | _____ | _____ |
| A variety of tasks? | _____ | _____ |
| Working alone? | _____ | _____ |
| Working with others? | _____ | _____ |
| Working in one place? | _____ | _____ |
| Specific educational requirements? | _____ | _____ |
| Fringe benefits? | _____ | _____ |
| Promotions? | _____ | _____ |

2. Match your answers from the self-analysis with the job analysis chart. Place an "X" in the job title square of those jobs which suit your career requirements.

   After you have completed the entry-level job analysis chart, ask your instructor to identify the entry-level jobs you have chosen. Write the job names under your "X."

## Entry Level Job Analysis

| JOB TITLE | Regular Working Hrs. | Indoor Work | Out Door Work | Year Round Work | Task Variety | Work Alone | Work W/Others | Work In One Place | Specific Vocational Requirements | Fringe Benefits | Promotions |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Y w/Some Overtime Usually Required | Y | N | Y | Y | N | Y | Y | HS Dipolma w/Course in Agriculture or Horticulture | Y | Y |
|  | Y Except At Peak Season | N | Y | Y | Y | N | Y | Y | " | Some | Y |
|  | Y Except At Peak Season | Y | Y | Y | Y | N | Y | Y | " | " | Y |
|  | Y | N | Y | N | Y | N | Y | Y | " | N | Y |
|  | Y w/Occasional Overtime | N | Y | Y | Y | Y | N | Y | " | May Be Some | Y |
|  | Y | N | Y | Y | Y | N | Y | Y | " | N | Y |
|  | Y w/Some Overtime | Y | N | Y | N | N | Y | Y | " | Y | Y |
|  | N | N | Y | N | Y | N | Y | Y | " | May Be Some | Y |
|  | N Seasonal | N | Y | N | Y | N | Y | Y | " | " | Y |
|  | N Seasonal | N | Y | N | Y | N | Y | Y | " | " | Y |
|  | Y Seasonal | Y | N | Y | Y | N | Y | Y | " | Y | Y |

NAME ______________________

## USE TAXONOMIC TERMINOLOGY

**INTRODUCTION**

Although it may seem like Greek or Latin to you, binomial naming is easy and even enjoyable. Review the information in Supplements 1 through 3.

**DIRECTION**

1. Using a seed catalog or plant encyclopedia, find three plants that share the same family. Describe how they differ.

   a. ______________________

   ______________________

   b. ______________________

   ______________________

   c. ______________________

2. Using the same catalog or encyclopedia, find three plants which are different species of the same genus. Describe how they differ.

   a. ______________________

   ______________________

   b. ______________________

   ______________________

   c. ______________________

   ______________________

3. Using the same catalog or encyclopedia, find three varieties of the same species. Describe how they differ.

   a. ____________________________________________

   ____________________________________________

   b. ____________________________________________

   ____________________________________________

   c. ____________________________________________

   ____________________________________________

4. You may have noticed that genus is often named for the botanist who discovered the plant, and species may indicate the geographical location, blooming season, or description of the plant's flowers.

   Discover your own species! Practice binomial naming by creating three plant names. Be sure to follow all the conventions for writing plant names.

   a. ____________________________________________
   b. ____________________________________________
   c. ____________________________________________

# ENTRY LEVEL J0B ANALYSIS

| JOB TITLE | Regular Working Hrs. | Indoor Work | Out Door Work | Year Round Work | Task Variety | Work Alone | Work W/Others | Work In One Place | Specific Vocational Requirements | Fringe Benefits | Promotions |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Green-House Worker | Y w/Some Overtime Required | Y | N | Y | Y | N | Y | Y | HS Dipolma w/Course in Agriculture or Horticulture | Y | Y |
| Nursery Worker | Y Except At Peak Season | N | Y | Y | Y | N | Y | Y | " | Some | Y |
| Garden Center Worker | Y Except At Peak Season | Y | Y | Y | Y | N | Y | Y | " | " | Y |
| Golf Course Attendent | Y | N | Y | N | Y | N | Y | Y | " | N | Y |
| Asst. Grounds Keeper | Y w/Occasional Overtime | N | Y | Y | Y | Y | N | Y | " | May Be Some | Y |
| Park Worker | Y | N | Y | Y | Y | N | Y | Y | " | N | Y |
| Employee Floral Design Shop | Y w/Some Overtime | Y | N | Y | N | N | Y | Y | " | Y | Y |
| Small Fruit Grower's Employee | N Seasonal | N | Y | N | Y | N | Y | Y | " | May Be Some | Y |
| Vegetable Grower | N Seasonal | N | Y | N | Y | N | Y | Y | " | " | Y |
| Orchard Employee | N Seasonal | N | Y | N | Y | N | Y | Y | " | " | Y |
| Lab Worker | Y | Y | N | Y | Y | N | Y | Y | " | Y | Y |

**ASSIGNMENT SHEET 1**

# INTRODUCTION TO HORTICULTURE

# I

NAME ______________________________ SCORE_______

**OBJECTIVE 11**

**Solve conversion problems.**

**INTRODUCTION**

Horticulture operations involve the use of many different materials. Any application requires correct amounts. An error in estimation as to the amount of fertilizer concentrate needed can affect the value of an entire crop. Knowing how to compute units of measure and basic volumes is a skill you will use repeatedly on the job.

**DIRECTIONS**

All quantities or distances in a problem must be expressed in like terms.

Refer to Objective 7 in the Information Sheet for measures and equivalents.

EXAMPLES: Feet + feet, inches — inches, gallons + gallons, yd. x yd.

You cannot perform any mathematical operations with unlike terms such as quarts and gallon. You must convert one of the quantities to the same measure as the other or others. It is usually better to convert larger units to smaller units; but if the problem is simple enough, it is faster and easier to convert from smaller units to larger units.

Multiply to convert larger units to smaller units.

EXAMPLE: Convert 8 gallons to quarts.

8 x 4 = 32 quarts

Divide to convert from smaller units to larger units.

EXAMPLE: Convert 32 quarts to gallons.

32 — 4 = 8 gallons

Conversions:

Use Objective 6 of the Information Sheet as needed to convert the following measures. Round off answers to the nearest tenth.

1. 48 in. = ______ ft.
2. 312 ft. = ______ yd.
3. 8 cu. yd. = ______ cu. ft.
4. 7 sq. yd. = ______ sq. ft.
5. 11 gal. = ______ qt.
6. 6 pt. = ______ qt.
7. 3/4 mi. = ______ ft.
8. 1260 sq. ft. = ______ sq. yd.
9. 246 sq. in. = ______ sq. ft.
10. 5120 acres = ______ sq. mi.
11. 128 oz. = ______ qt.
12. 398 in. = ______ yd.
13. How many quarts are in a 55-gal. drum?______________
14. How many cubic yards or soil are in 3,078 cu. ft.?______

NAME ______________________________ SCORE _______

**OBJECTIVE 12**

**Solve problems using the formulas for area and volume.**

**INTRODUCTION**

On many occasions, a horticulturist will find it necessary to be able to calculate area and volume. For example, you may need to know how much soil is necessary for a large planter, or you may need to calculate the areas to be covered by flowering shrubs, plants, and flowers in an outdoor display.

**DIRECTIONS**

Solve the problems below. Refer to Objective 8 in the Information Sheet for more information.

Area expressed in square units equals length times width:

A = L x W

Volume expressed in cubic units equals length times width times height:

V = L x W x H

Area of triangle expressed in square units equals one-half base times height:

A = 1/2B x H

**PART 1**

1. Figure surface area
   a. 24' x 18'______ sq. ft.
   b. 13 in. x 2 1/2 ft.______ sq. ft.
2. Figure volume
   a. 7 ft. x 2 ft. x 1 ft.______ cu. ft.
   b. 4 in. x 2 in. x 1/2 in.______ cu.in.

3. Figure the area of triangles

   a. Base = 16 in., height = 20 in.______ sq. in. or______ sq. ft.

   b. Height = 3 ft., base = 8 ft.______ sq. ft. or______ sq. yd.

**PART 2** Read the problems carefully to determine what is required and what mathematical operations are needed.

EXAMPLE: How many cubic yards of soil media will be required to fill a planting bed patch 12 feet long, 6 feet wide and 9 inches deep?

(a) The question asks for volume.

(b) The formula for volume is L x W x H.

(c) The problem is stated in feet and inches; you will have to convert inches to feet (12 in. = 1 ft.).

(d) The answer is in cubic yards; you will have to convert cubic feet to cubic yards (27 cu. ft. = 1 cu. yd.)

Write out the formula; determine the length, width, and height; and calculate the volume.

EXAMPLE:

9 in = 0.75 ft (conversion)

$V = L \times W \times H$

$V = 12 \times 6 \times 0.75$

$= 72 \times 0.75$

$= 54$ cu. ft.

$$= 54 \text{ cu. ft.} / \frac{27 \text{ cu. ft.}}{\text{cu. yd.}}$$

$$= \frac{54 \text{ cu. ft.}}{1} \times \frac{\text{cu. yd.}}{27 \text{ cu. ft.}}$$

$$= \frac{54}{27} \text{ cu. yd.}$$

$= 2$ cu. yd.

Solve the following problems. Round off answers to the nearest tenth. Show your work.

1. One cubic yard of mulching gravel weighs 2,550 lb. How many tons would 10 cu. yds. weigh?

   (1 ton = 2,000 lb.)

   ___ tons

2. What is the surface area of a potting table 3 ft. by 6 ft.?

   ___ sq. ft.

3. What is the surface area of flower border 2 ft. 8 in. by 1 ft. 6 in.?

   ___ sq. ft.?

4. How many cubic feet of soil mix will be required to fill a planter 8 ft. long, 7 ft. wide, and 6 in. deep?

   ___ cu. ft.

5. How many cubic yards of soil will be required to make a raised flower bed 15 in. deep, 12 ft. long, and 8 ft. wide?

   ___ cu. yds.

## ASSIGNMENT SHEET 3 — INTRODUCTION TO HORTICULTURE — I

NAME ______________________________ SCORE _______

**OBJECTIVE 13** **Calculate basic mix ratios.**

**INTRODUCTION** As a horticulturist, you will have to figure mix ratios and combine materials for fueling equipment, spraying fertilizer and pesticides, and making soil mixtures.

**DIRECTIONS** Calculate mix ratios. Refer to Objective 9 of the Information Sheet.

1. Given 30 cu. ft. of peat moss you are to mix peat moss and sand to a ratio of 3:1. How much sand will you need?

   ______ cu. ft. of sand

2. Given 9 cu yd of peat moss how much soil will you need to mix a 3:2 ratio of soil and peat moss?

   ______ cu. yd. of soil

3. You are to mix 1/4" gravel and 1/2" gravel to a ratio of 3:2. How much 1/4" gravel will you need if you have 150 cu. yd. of 1/2" gravel?

   ______ cu. yd. of 1/4" gravel

4. Given 30 gallons of water, mix water and glass cleaner to a ratio of 75:25. How much glass cleaner will you need?

   ______ gal. of glass cleaner

5. The fuel mixture ratio of gasoline to two-cycle engine oil is 20:1 for your chain saw. How much oil will you add to 5 gal. of gas?

   ______ qt. of oil

6. The greenhouse crew is having a fish fry. You are to make the tartar sauce of pickle relish, mayonnaise, and lemon juice at a ratio of 1.5:2:0.2. You estimate one 32-oz. jar of mayonnaise will be enough. How much pickle relish and lemon juice will you mix with the mayonnaise?

_____ oz. pickle relish

_____ oz. lemon juice

**ASSIGNMENT SHEET 4**

# INTRODUCTION TO HORTICULTURE

# I

NAME ______________________________ SCORE _______

**OBJECTIVE 12**

**Calculate slope ratios.**

The landscaper needs to figure slope ratios for mowing and for planting on slopes. Steeper slopes require additional safety procedures to keep equipment upright.

**DIRECTIONS**

Find the slope ratio in feet and in inches. Convert distances to like terms where needed. Round off to the nearest hundredth. Refer to Objective 10 of the Information Sheet.

V = vertical distance

H = horizontal distance

| Distances | Ratio(feet) | Ratio(inches) | Slope Ratio |
|---|---|---|---|
| 1. V = 12 ft; H = 24 ft | | | |
| 2. H = 15 in; V = 5 in | | | |
| 3. H = 5 ft; V = 0.05 ft | | | |
| 4. V = 1 in; H = 3 ft | | | |
| 5. H = 12 ft; V = 4 in | | | |
| 6. V = 2 in; H = 8 ft | | | |

## ASSIGNMENT SHEET 1

1. 4 ft.
2. 104 yd.
3. 216 cu. ft.
4. 63 sq. ft.
5. 44 qt.
6. 3 qt.
7. 3,960 ft.
8. 140 sq. yd.
9. 1.7 sq. mi.
10. 8 sq. mi.
11. 4 qt.
12. 11 yd.
13. 220 qt.
14. 114 cu. yd.

## ASSIGNMENT SHEET 2

### PART 1

1. a. 432 sq. ft.
   b. 2.7 sq. ft.
2. a. 14 cu. ft.
   b. 4 cu. in.

3. a. 160 sq. in., 1.11 sq. ft.
   b. 12 sq. ft., 1.33 sq. yd.

**PART 2**

1. 12.8 tons
2. 18 sq. ft.
3. 2 sq. ft.
4. 28 cu. ft.
5. 4.4 cu. yd.

**ASSIGNMENT SHEET 3**

1. 10 cu. ft. of sand
2. 13.5 cu. yd. of soil
3. 225 cu. yd. of 1/4" gravel
4. 10 gal. of glass cleaner
5. 1 qt. of oil
6. 24 oz. of pickle relis
   3.2 oz. of lemon juice

**ASSIGNMENT SHEET 4**

| | RATIO(FEET) | RATIO(INCHES) | SLOPE RATIO |
|---|---|---|---|
| 1. | 24:12 | ——— | 2:1 |
| 2. | ——— | 15:5 | 3:1 |
| 3. | 5:0.05 | 60:0.6 | 100:1 |
| 4. | 3:0.08 | 36:1 | 36:1 |
| 5. | 12:0.33 | 144:4 | 36:1 |
| 6. | 8:0.17 | 96:2 | 48:1 |

**WRITTEN TEST**

## INTRODUCTION TO HORTICULTURE

## I

NAME ______________________________ SCORE _______

**OBJECTIVE 1**

**Match the branches and divisions of the horticultural tree with their definitions.** Write the correct numbers in the blanks. (Question is continued on the following page.)

___ 1. Involves the planning and constructing of landscapes that will enhance and protect the beauty of the surrounding environment

___ 2. Involves the planting, transplanting, fertilizing, pruning, bracing, disease control, and general cure of trees and shrubs

___ 3. Involves all the aspects related to beautifying or improving the appearance of a particular environment

___ 4. Involves the study of growing fruits, nuts, vegetables and ornamental plants

___ 5. Involves the production and care of vegetables

___ 6. Involves the production, harvesting, and marketing of fruits

___ 7. Involves the science, business, and art of cultivating the soil

___ 8. Involves the cultivation and sale of ornamental and flowering plants

___ 9. Involves developing grasses used in athletic fields, golf courses, parks, and cemeteries

a. Agriculture
b. Agronomy
c. Botany
d. Forestry
e. Horticulture
f. Arboriculture
g. Olericulture
h. Pomoculture
i. Biology
j. Pomology
k. Ornamental horticulture
l. Floriculture
m. Landscaping
n. Nursery production
o. Turf grass production
p. Zoology
q. Microplantology
r. Grave attendant

___10. Involves the study of field crops, such as corn, wheat, alfalfa, and rice

___11. Involves the study of plant life and the many elements that affect plant life

___12. Involves the study of the cultivation, maintenance, and development of forests

___13. Involves the production, harvesting and sale of ornamental trees and shrubs

**OBJECTIVE 2** **Describe the values of horticulture.**

**OBJECTIVE 3** **List four occupational tasks associated with each horticultural specialty.**

**Arboriculture**

**Floriculture**

________________________________________

________________________________________

________________________________________

________________________________________

**Fruit and Nut Production**

________________________________________

________________________________________

________________________________________

________________________________________

**Greenhouse operation**

________________________________________

________________________________________

________________________________________

________________________________________

**Interior plantscaper**

________________________________________

________________________________________

________________________________________

________________________________________

**Landscape management**

________________________________________

________________________________________

________________________________________

________________________________________

**Vegetable production**

________________________________________

________________________________________

________________________________________

________________________________________

**Garden center operator**

________________________________________

________________________________________

________________________________________

________________________________________

**OBJECTIVE 4**

**Arrange in order the levels of the horticultural career ladder.** Write the levels in proper order on the lines provided.

1. ______________________________________
2. ______________________________________
3. ______________________________________
4. ______________________________________

**OBJECTIVE 5** **Identify position descriptions associated with each level of the horticultural career ladder.** Write two position descriptions for each level of the career ladder that you named above.

Level 1: ____________________

Level 1: ____________________

Level 2: ____________________

Level 2: ____________________

Level 3: ____________________

Level 3: ____________________

Level 4: ____________________

Level 4: ____________________

**OBJECTIVE 6** **Distinguish among plant nomenclature and taxonomy terms.**

1. Write "C" in the blanks before common names and "B" in the blanks before Binomial names.

    ____ a. *Variegated Chinese Evergreen*

    ____ b. *Brassaia acctinophylla*

    ____ c. *Black-eyed Susan*

    ____ d. *Philodendron pertusum*

    ____ e. *Dracaena godseffiana*

    ____ f. *Queen Elizabeth Rose*

2. Write "G" in the blanks before genus, "S" in the blanks before species, and "V" in the blanks before variety. Answers may require more than one letter.

    ____ a. *Euphorbia*

    ____ b. *Fatsia japanica A. seiboldi*

    ____ c. *pulcherrima*

    ____ d. *aureuru*

    ____ e. *Epipremnium*

    ____ f. *Phiodendron cordatum, Hoya var.*

____ g. *Syngonium*

____ h. *pod phyllum*

**OBJECTIVE 7**

**Match standard measures to their equivalents.** Write the correct numbers in the blanks.

**Linear measure**

____1. 1,760 yd.

____2. 3 ft.

**Surface measure**

____3. 4,840 sq. yd.

____4. 144 sq. in..

____5. 640 acres

**Cubic measure**

____6. 1,728 cu. in.

____7. 27 cu. ft.

**Liquid measure**

____8. 2 pt.

____9. 16 oz.

___10. 30 gal.

___11. 4 qt.

a. 1 yd.

b. 1 mile

c. 1 ft.

d. 1 acre

e. 1 sq. in.

f. 1 sq. ft.

g. 1 sq. mi.

h. 1 cu. ft.

i. 1 cu. yd.

j. 1 gal.

k. 1 drum

l. 1 pt.

m. 8 1/2 pounds

n. 1 qt.

o. 1/2 drum

**OBJECTIVE 8**

**Write the basic formulas for surface area, area of a triangle, and volume.**

1. Surface area ______________________________

2. Volume ______________________________

3. Area of a triangle ______________________________

**OBJECTIVE 9**

**Calculate mix ratios.** Write the answer in the blank provided.

1. Chain saw fuel has a 20:1 ratio of gasoline to oil. How much oil will you add to 5 gallons of gasoline?

   _____ gal.

2. Given 6 cu. yd. of vermiculite, you are to mix vermiculite and perlite in a 3:2 ratio. How much perlite will you need?

   _____ perlite

3. The humus, soil, and sand ratio for planter is 2:2:1. You will use 4 cu. ft of soil. How much humus and how much sand will be used?

   _____ cu. ft. of humus

   _____ cu. ft. of sand

4. A cleaning agent requires an additive at a ratio of 15:2. If you store 30 gallons of cleaning agent, how many gallons of additive should also be stored?

   _____ gallons

**OBJECTIVE 10**

**Calculate slope ratios.** Round off answers to the nearest tenth.

1. What is the slope ratio if the vertical distance is 4 feet and the horizontal distance is 140 feet?

   _____ ft.

2. Find the vertical distance with a slope ratio of 5:1 and a horizontal distance of 100 ft.

   _____ ft.

3. **Find the horizontal distance when the vertical distance is 2 ft. and the slope ratio is 8:1.**

____ ft.

**NOTICE** **In addition to the written test items, the student will be required to demonstrate mastery of the following objectives.**

| | | |
|---|---|---|
| **OBJECTIVE 11** | **Solve conversion problems.** | SCORE ________ |
| **OBJECTIVE 12** | **Solve problems using the formulas for area and volume.** | SCORE ________ |
| **OBJECTIVE 13** | **Calculate basic mix ratios.** | SCORE ________ |
| **OBJECTIVE 14** | **Calculate slope ratios.** | SCORE ________ |

## WRITTEN TEST ANSWERS

## INTRODUCTION TO HORTICULTURE

## I

**OBJECTIVE 1**

1. m
2. f
3. k
4. e
5. g
6. j
7. a
8. l
9. o
10. b
11. c
12. d
13. n

**OBJECTIVE 2**

- Aesthetic—Value placed on a plant's ability to beautify a given environment.
- Economic—Value placed on the number of jobs and the amount of money generated by horticultural products in the community
- Educational—Value placed on the study of plants as they related to themselves, other plants, and the larger environment
- Nutritional—Value placed on the nutrient or food benefits received from horticultural products
- Recreational—Value placed on the leisure benefits received from horticultural activities and products

**OBJECTIVE 3**

Answer should include four tasks from each specialty below.

- Arboriculture—Identify woody plants; prune shrubs; prune trees; treat tree cavities and bark wounds; identify environmental damage to trees and shrubs; protect trees and shrubs; from environmental hazards; brace and cable trees; fertilize trees; control insects and pests; control tree diseases

- Floriculture—Controls plant environment, stores, ships and takes inventory; services and maintains equipment and facilities; performs general office work; performs sales and sales-related duties; maintain and construct structures; manage the business; apply safety practices; design floral arrangements

- Fruit and Nut Production—Prep area and improve soil; propagate plants, seeds and cuttings; maintain plants; harvest fruits and nuts; grow crops; control plant and environment; control diseases, weeds, and pests; maintain and repair equipment and facilities; operate equipment; use irrigation systems; grade and package crops; sell products

- Greenhouse operation—Propagates plants, seeds and cuttings; prepare soils and planting media; controls plant environment; apply fertilizers and chemicals; harvests plants; store, ship and take inventory; service an maintain equipment and facilities; operate equipment; use irrigation systems; grade and package crops; sell products

- Landscape management—Prepare and improve soil; propagate plates, seeds, and cuttings; maintain plants; grow plants; control plant environment; control diseases, weeds, and pests; maintain and repair equipment; use irrigation system; store, ship, take inventory and maintain merchandise; sell products, design exterior landscape; work with architects, planners and designers

- Vegetable production—Prepare land for planting; plant and transplant crops; cultivate and irrigate crops; apply fertilizers and pesticides; construct and maintain buildings and structures for storage; maintain equipment and vehicles; grow seedlings; use irrigation systems; harvest vegetable crops; grade and package crops; store, ship, take inventory, and maintain merchandise; sell products

- Garden center operations—Open and close store; keep business records; prepare written and oral communications for the public; display merchandise; sell products; handle merchandise; maintain plants; prepare plants for sale; control plant environment; inspect and diagnose plant problems; maintain hand tools and equipment; maintain power equipment; design landscapes; maintain facilities.

**OBJECTIVE 4**

- Manager
- Supervisor
- Intermediate
- Entry-level

**OBJECTIVE 5**

Answer may include any 2 of the following:

**Entry level position—**

- Involves on the job training
- Involves a great deal of manual labor
- Involves mechanical and technical tasks
- Requires skills using equipment and tools
- Requires knowledge about plants
- Requires worker to perform will with minimum supervision

Answer may include any 2 of the following:

**Intermediate position—**

- Attained through work experience and/or continuing education
- Requires some business knowledge and experience
- Requires knowledge about plant production and selling
- Requires skills and knowledge to operate machinery and equipment

Answer may include any 2 of the following:

**Supervisory position—**

- Requires vocational training and/or some college education, such as associate degree
- Generally achieved through promotion
- Requires guiding and directing employees in their work
- Requires broad knowledge of the horticultural industry

Answer may include any 2 of the following:

**Managerial position—**

- Requires specialized training, such as a college degree or equivalent
- Requires experience in the horticulture industry
- Requires skills to direct people and tasks
- Requires the ability to make sound decisions with the information available
- Requires financial management skills
- May require long and irregular hours

**OBJECTIVE 6**

1. a. C
   b. B
   c. C
   d. B
   e. B
   f. C
2. a. G
   b. V
   c. S
   d. S
   e. G
   f. V
   g. G
   h. S

**OBJECTIVE 7**

1. b
2. a
3. d
4. f
5. g
6. h
7. i
8. n
9. l
10. o
11. j

**OBJECTIVE 8**

1. Area = Length x width
2. Volume = Length x width x height
3. Area = 1/2 Base x height

**OBJECTIVE 9**

1. .25 or 1/4
2. 4
3. 4, 2
4. 4

**OBJECTIVE 10**

1. 35:1
2. 20
3. 16

**OBJECTIVE 11** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 12** Refer to answers to Assignment Sheet 2.

**OBJECTIVE 13** Refer to answers to Assignment Sheet 3.

**OBJECTIVE 14** Refer to answers to Assignment Sheet 4.

**OBJECTIVE SHEET**

# BEGINNING A CAREER IN HORTICULTURE

# II

**INTRODUCTION**

There is more to horticulture than having a "green thumb." As most experienced gardeners and landscapers know, working with plants takes time, dedication, and knowledge. Working with plants, shrubs, and trees can lead to a rewarding and lucrative career, whether it's tending to plants in a greenhouse setting or working outdoors as a landscaper. There will always be a need not only for people who can grow and maintain decorative flowers and plants, but for orchard and farm workers who help harvest fruits, nuts, vegetables, and berries.

**UNIT OBJECTIVE**

After completing this unit, the student should be able to identify horticulture specialties and identify places to look for a job. The student also should be able to complete an employment application. The student will demonstrate these competencies by completing the assignment sheets and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with careers in horticulture to their correct definitions.
2. Recall the importance of personal characteristics that employers seek in employees by arranging a list of the characteristics in the same order as they are ranked by employers.
3. Select from a list places to seek help in finding a job.
4. Distinguish between the characteristics of private and public employment agencies.
5. Identify places that hire horticulturists.
6. Arrange in order steps in a practical job-seeking plan.
7. Distinguish between information to be obtained before and during a job interview.
8. Select from a list guidelines for dressing for an interview.
9. Select from a list recommended interviewing practices.

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10. Select from a list points the interviewer looks for during the interview.

11. Analyze work situations to determine the importance of employee attitudes. (Assignment Sheet 1)

12. Write information needed on a résumé. (Assignment Sheet 2)

13. Complete an employment application. (Assignment Sheet 3)

14. Find and analyze job possibilities in a newspaper. (Assignment Sheet 4)

15. Prepare opening for a job interview. (Assignment Sheet 5)

16. Practice basic interview answers. (Assignment Sheet 6)

**SUGGESTED ACTIVITIES**

## BEGINNING A CAREER IN HORTICULTURE

## II

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Review teaching suggestions and plan classroom activities.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Arrange for a field trip to local

    - Garden centers
    - Nurseries
    - Greenhouses
    - Landscaping companies
    - Farms
    - Orchards
    - Parks
    - College or university horticulture departments
    - Golf courses
    - Tree companies
    - Pest control companies
    - Lawn doctors

- Invite local growers, orchardists, florists, floral designers, greenhouse managers, arborists, arboriculturists, interior and exterior plantscapers, and landscapers to visit the classroom. Supply guest speakers with objective sheet, information sheet, supplements, or any other pertinent material you wish them to cover.

- Assemble local yellow page listings of various horticultural employers.

- Assemble classified sections of local, state, regional newspapers showing employment opportunities in horticulture.

- Ask local horticultural employers to provide you with copies of successful letters of application and résumés. Make sure to delete all identifying information such as names, addresses, and phone numbers from this material.

- Arrange for video-tape equipment and television to record and playback role-play interviews for analysis.

DELIVERY

**Objective 1**

- Give examples of local opportunities to practice the various horticultural careers, or have students share their findings from Unit I.

**Objective 2**

- Invite employment counselors to discuss personal characteristics.
- Invite horticultural career supervisors and managers to discuss personal characteristics.
- Have students complete Activity Sheet 1 to evaluate work attitudes.

**Objectives 3 through 7**

- Invite representatives from private and public employment agencies to discuss the career search and local opportunities in horticulture.
- Have students complete Activity Sheet 2 to help them explore horticulture job opportunities.
- Provide students with successful résumés as models. Analyze and discuss strengths of these résumés.

**Objective 8**

- Show slides of appropriate and inappropriate interview outfits.
- Invite local dress-for-success consultants to visit and demonstrate interview attire for various positions on the career ladder.
- Have students come to class dressed in outfits and accessories they would wear to interview. As a class, critique each student's attire.

**Objectives 9 and 10**

- Discuss as a class and individually with each student how to maximize personal strengths in an interview situation.

- Provide students with actual successful letters of application.
- Discuss the strengths of these letters.
- Discuss how students can use these models to personalize their own letters.
- Have students complete Activity Sheet 3 to assist them in writing letters of application.
- Have students complete Activity Sheet 5 to practice interview answers.
- Have students complete Activity Sheet 6 to practice interviewing.
- Video-tape students as they role-play interview situations and ask students to analyze their strengths and weaknesses, keeping a list of each.
- After analysis, re-tape interview role-playing and ask students to compare two performances. Question how students have improved previous performance.
- Have students use Activity Sheet 4 to assist them in evaluating the interview situation.

## APPLICATION

**Objectives 11 through 16**

- Use Assignment Sheet 1 to help students analyze the importance of employee attitudes and personal characteristics.
- Use Assignment Sheet 2 to help students prepare a résumé.
- Use Assignment Sheet 3 to help students locate job possibilities in the newspaper.
- Use Assignment Sheet 4 to help students complete an employment application.
- Use Assignment Sheet 5 to help students prepare an opening for a job interview.
- Use Assignment Sheet 6 to prepare interview answers.

## EVALUATION

**Written Test**

- Explain to the students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *How Do I Find a Job?* 1/2" video; color; 13 min.; Agency for Industrial Tech, 1983. Order No. VO31. The host presents advantages and disadvantages of several ways to find job openings. Joe telephones to follow up on an opening for a mechanic. On his first try, he is nervous and ill-prepared. He does much better when he has planned what he will say.
- *Your Personal Appearance*. 16mm; color; 10 min.; National Education Media, 1982, Order No. F334. Stresses the importance of proper dress habits to make a good first impression. Shows how to dress appropriately considering the time, place, and business transaction.
- *The Application*. 1/2" video; color; 11 min.; Agency for Industrial Tech, 1983, Order No. VO33. The host explains that the application represents the applicant to the employer. Susan and Alan illustrate how poorly prepared applicants can make a bad impression. Lucy arrives on time with a pen and complete information, fills out the form adequately and truthfully, and carefully reviews it before returning it.
- *Applying for a Job*. 16mm; color; 13 min.; Order No. FII4. Shows some of the ways in which a first job may be obtained. This film indicates the wide range of services provided by a state employment agency. Actual job application, interview procedures, and some of the kinds of people who will be encouraged are illustrated.
- *Opening Doors*. 1/2" video; color; 13 min.; Agency for Industrial Tech, 1983, Order No. VO32. The host explains

that job seeking is easier if the seeker is prepared with a job history, a letter of application, and references or recommendations. Pete learns from a personnel director how to organize these materials and use them in applying for a job.

- *Get that Job: Line up Your Interview.* 16mm; color; 13 min.; Coronet Films, 1976, Order No. FO25. The viewer learns how to organize a résumé, how to write an effective introductory letter, how to choose the right job objective, and how to get the job.
- *The Interview.* 1/2" video; color; 13 min.; Agency for Industrial Tech, 1983, order No. VO35. Mrs. Hinson interviews Lucy for a clerical job and Tim for a maintenance position. Both candidates demonstrate proper interview behavior.
- *Interview: Ready or Not?* 16mm; color; 24 min.; Churchill Films, 1975, Order No. FO88. This film describes the importance of a positive self-concept in selling yourself in a job interview.
- *Job Interview: I Guess I Got the Job.* 16mm; color; 15 min.; McGraw-Hill Films, 1975, Order No. FO89. Through flashbacks, this film views the totally different approaches of two male applicants applying for the same position and the resulting impression each leaves with the interviewer.

**NOTE:** These films are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

**Pamphlets**

- *How to Get and Hold the Right Job*
- *How to Prepare Yourself for Job Interviews*
- *How to "Sell Yourself" to an Employer*

**NOTE:** All the above are available from the nearest state employment service office.

- *Appointment With Tomorrow.* Vaseco, Inc., 2301 Classen Boulevard, P.O. Box 60274, Oklahoma City, Oklahoma 73106.

- *How Not to Blow a Job Interview.* Pamphlet available free from Army Reserve recruiter. U.S. Government Printing Office, 1978.

- *Making the Most of Your Job Interview.* Pamphlet available free from New York Life Insurance Company, 51 Madison Avenue, New York, New York 10010.

## UNIT REFERENCES

**Publications**

- Brewer, Margaret, et al. *Life Skills Attitudes on the Job.* New York, New York: Educational Design, Inc., 1980.

- Oklahoma Job Service. "Before the Interview." Oklahoma City: Oklahoma State Employment Service, n.d.

- Oklahoma Job Service. "How Do I Get a Job?" Oklahoma City: Oklahoma State Employment Service, n.d.

- Oklahoma Job Service. "Résumé Completion Guideline." Oklahoma City: Oklahoma State Employment Service, n.d.

- Oklahoma State Department of Education. *One of a Kind: A Practical Guide to Learning Styles.* Oklahoma City: State Department of Education, 1982.

  **NOTE:** The above publication is available to Oklahoma teachers from the State Department of Education, Curriculum Division, Oliver Hodge Building, Oklahoma City, Oklahoma 73105

- Patton, Bob, et. al. *VICA: Learn, Grow, Become.* Stillwater, Oklahoma: State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1984.

- Tesolowski, Dennis G. *Job Readiness Training Curriculum.* Menomonie, Wisconsin: University of Wisconsin-Stout, 1979.

| INFORMATION SHEET | BEGINNING A CAREER IN HORTICULTURE | II |
|---|---|---|

**OBJECTIVE 1**

**Match terms associated with careers in horticulture to their correct definitions.**

- **Horticulturist**—Person who practices the art or science of cultivating fruits, vegetables, flowers, and plants
- **Arboriculturist**—Person who cultivates trees and shrubs, especially for ornamental purposes
- **Arborist**—Specialist in planting and transplanting, pruning, and diagnosing the ailments of trees in tree surgery and tree maintenance
- **Florist**—A person whose business is raising or selling flowers and ornamental plants
- **Floral designer**—Person who designs and constructs floral and plant arrangements
- **Interior plantscaper**—Person who designs and constructs interior landscapes to enhance the beauty of the surrounding environment
- **Landscaper**—Person who designs and constructs exterior landscapes to enhance and protect the beauty of the surrounding environment
- **Orchardist**—Person whose business is raising and selling fruits and nuts, cultivating and maintaining orchards
- **Groundskeeper**—Person whose business is cultivating and maintaining plants, trees, shrubs, flowers, and turf
- **Greenhouse manager**—Person who supervises greenhouse operations, including all business and horticultural activities

**OBJECTIVE 2**

**Recall the importance of personal characteristics that employers seek in employees by arranging a list of characteristics in the same order as they are ranked by employers.** (Activity Sheet 1)

**NOTE:** The definition below rank characteristics that employers have said are most important to them when hiring someone. They are important characteristics for a horticulturist to have.

1. **Honesty**—Quality of a person who is truthful, fair, and straightforward
2. **Reliability**—Quality of a person who is dependable, and who can be counted upon
3. **Cheerfulness**—Quality of a person who tends to be happy and hopeful, and who encourages others to be so
4. **Diligence**—Quality of a person who gives steady, earnest, and energetic effort to a task, who keeps trying patiently until the task is done
5. **Enthusiasm**—Quality of a person who shows interest in and excitement for what he or she is doing
6. **Cooperativeness**—Quality of a person who is willing and able to work with others, and to share in the labor and rewards
7. **Loyalty**—Quality of a person who is faithful to another person or organization and who supports the others through words and actions

A general rule about getting and keeping a job is that you're hired based on your skills and fired based on your attitudes. What this means is that a person may be trained to do a job, such as being a floral designer. The person may even be very skilled at that job, and those skills may impress an employer so that the floral designer is hired. However, if after the person is hired, he or she turns out to be lazy or uncooperative, dishonest or unreliable, that person may lose the job. The purpose of any training program should be more than just helping you find a job. The training should also help you to keep the job, to find satisfaction in your work, and to get promoted to a higher-paying and more responsible position. Therefore, you must learn to work not only with plants, soils, fertilizers, tools, and reference materials, but also with bosses, co-workers, and customers. As a result, during your training you will study not only the information and procedures required in horticultural work, but you will also study and practice attitudes important to your job success.

**OBJECTIVE 3** **Select from a list places to seek help in finding a job.**

**NOTE:** Finding a job is a full-time job itself. Begin a career search by listing local places that can help you to plan and execute your career search. Keep a file with up-to-date lists of all possible outlets to help you in finding a job. Keep a positive attitude; in job hunting, persistence pays!

- Employment agencies
- School counselor
- Newspaper ads
- Friends and relatives

  **NOTE:** Be sure to let people know the type of horticultural work you desire.
- Horticulture teachers
- Past employers

**OBJECTIVE 4** **Distinguish between the characteristics of private and public employment agencies.**

- **Private agencies** are listed in the yellow pages. They charge a fee for their services, usually a percentage of your beginning salary. They offer limited general areas of employment and specialized areas of employment, such as medicine or engineering. An appointment is required.
- **Public employment agency**—Your state's employment service. The state offices do not charge a fee for their services. They offer all areas of employment. No appointment is required. The agency is listed under the state name in the white pages of the telephone book

  EXAMPLE: OKLAHOMA, STATE OF—

**OBJECTIVE 5** **Identify places that hire horticulturists.** (Activity Sheet 2)

**NOTE:** As you continue your career search you may want to make a list of places that hire horticulturists in your local area. The career counselors you consult, the yellow pages, your horticulture teachers, and friends and relatives may all be of help in compiling this list.

- Garden centers
- Nurseries
- Greenhouses
- Florist shops
- Growers

  EXAMPLES: Farmers, orchard owners, floriculture growers
- Government agencies

  EXAMPLES: Universities, federal, state, county and city park systems
- Golf courses
- Tree and pest control companies

**OBJECTIVE 6** **Arrange in order steps in a practical job-seeking plan.** (Activity Sheet 3 and 4)

1. Complete a self inventory.
2. Determine employment possibilities.
3. Obtain employment application forms.
4. Prepare a résumé.
5. Complete employment application forms.
6. Mail résumé and application forms.
7. Determine specific information about the company

   **NOTE:** Sometimes you will fill out an application at the place of interview.
8. Arrange for an interview.

9. Prepare questions about job and employer.

   NOTE: Write these questions in a small notebook.

10. Prepare opening for job interview.

11. Practice interview answers.

12. Take a copy of your résumé and references to interview.

13. Take your driver's license or other proof of identity to interview.

14. Take a pen and small notebook to interview.

    NOTE: The notebook that you take should be the same one that contains your questions.

15. Evaluate interviewer's reaction.

16. Write a follow-up letter.

17. Evaluate a job offer.

**OBJECTIVE 7**

**Distinguish between information to be obtained before and during a job interview.** (Activity Sheet 5)

**BEFORE JOB INTERVIEW**

**NOTE:** It is important to learn all that you can about a company before you interview with them for a job. This information will help you to ask the right questions during the interview, which will improve your chances of getting the job you want.

- Products employer makes or services it renders
- How long employer has been in business
- If employer has expanded its business or changed its operations
- Name, position, and title of person who will be doing the interviewing
- How to pronounce the interviewer's name
- Typical salary for this type of job

## DURING JOB INTERVIEW

- Working conditions

  EXAMPLES: Hours of work, pay period, dress regulation, unions and professional organizations you may be expected to join, hiring policies

- Security and safety precautions
- Public relations

  EXAMPLES: Relations among company employees and the public

- Salary and/or wages
- Fringe benefits
- Seniority
- Opportunity for advancement

**OBJECTIVE 8** **Select from a list guidelines for dressing for an interview.**

**NOTE:** It is very important that the applicant make the best impression possible from the *beginning* of the interview. Most interviewers form an opinion within the first four to six minutes of the interview.

- Dress to fit the job for which you are applying

  **NOTE:** Dress better for the interview than you normally would for a day on the job.

- Coordinate clothing

  **NOTE:** Consider colors, patterns, fabrics, and suitable styles for your shape and body structure.

- Be conservative

  **NOTE:** Avoid wearing high-fashion items or the newest fads.

  EXAMPLES: Wear simple jewelry, natural looking makeup; avoid strong colognes or aftershaves; avoid wearing sunglasses during the interview.

- Be modest and well groomed

  EXAMPLES: Clean, simply styled hair; clean and neatly trimmed nails and facial hair; buttoned shirt/blouse; fashionable but modest skirt length; well-fitting clothes (not too tight); polished shoes

**OBJECTIVE 9** **Select from a list recommended interviewing practices.** (Activity Sheet 6)

NOTE: Your behavior before, during, and after your interview will strongly influence the impression that you make. The following practices will help you to "sell yourself" during an interview.

- Prepare for the interview
- Arrive early for the interview
- Go to the interview alone unless otherwise requested
- Introduce yourself to the receptionist or secretary and the interviewer; state the purpose of your visit
- Greet by name the person who will interview you

  NOTE: Be sure to pronounce the name correctly.
- Shake hands if the interviewer extends the offer

  NOTE: Make sure your handshake is firm.
- Sit down when the interviewer indicates that you should
- Sit quietly until the interviewer opens the interview
- Try not to show nervousness

  NOTE: Keep hands clasped in lap, if necessary, to keep them motionless.
- Maintain good posture
- Maintain eye contact with interviewer
- Listen carefully

  NOTE: This will enable you to answer the questions directly.

- Do not smoke or chew gum
- Show a real interest in the job about which you are asking
- Use good manners

  NOTE: Be courteous. Say "thank you" for services and attention given to you. Have a ready smile and a friendly attitude.

- Be brief, positive, and honest when answering questions

  NOTE: You should explain your answers fully. It is usually necessary to explain "yes" and "no" answers.

- Avoid using slang and offensive language
- Be ready to talk about individual work experiences and special skills
- Discuss positive aspects of self, not negative aspects of others or previous companies
- Wait until the end of the interview to ask question you have written down concerning the job

  EXAMPLES: When will you be notified? Must you return for a second interview?

- Politely thank the interviewer for his or her time and consideration
- Offer to provide the interviewer with any additional information

**OBJECTIVE 10** **Select from a list points the interviewer looks for during the interview.**

NOTE: The following points are not listed in order of importance. Different employers will place varying degrees of value on the items listed below.

- Preparation
- Experience
- Attitude
- Appearance
- Personality

NAME ________________________________

## EVALUATE YOUR WORK ATTITUDES

**INTRODUCTION**

You have learned in this unit that attitudes can be just as important as technical knowledge and job skills in career success. Your attitudes will affect how well you will do in your career and how well you will do in this training program. One attitude that you must develop is that you will have to study and practice throughout your career to stay current in the field because of new developments and changes in such areas as pesticides and fertilizers. you will also find that many customers rely on the advice of horticulturists. Thus, the abilities to work with people, to be a good listener, and to be thought of as honest and sincere will help you to succeed in horticulture. How well do you measure up?

In this assignment, you will get a chance to evaluate yourself in terms of your work attitudes. This assignment is for your own use. You do not need to share this information with anyone. Instead, use it to determine areas in which you need to improve. If you think that you could use some help in one or more areas, talk to your instructor about ways you can improve those attitudes and habits. If you do not feel comfortable asking for help this early in the training program, wait until you know your instructor better and discuss it then.

Save this activity sheet; as you go through your training, look at it again from time to time and ask whether your score has improved.

**DIRECTIONS**

Read the list on the following pages of actions and estimate how much they apply to you. Write an "X" over the number for how frequently you do the action described. If you do not work, consider how often each action is true for you in school.

| | Often | Sometimes | Never |
|---|---|---|---|
| 1. Missing work | 1 | 2 | 3 |
| 2. Arriving late for your job | 1 | 2 | 3 |
| 3. Being extremely friendly with your supervisor | 1 | 2 | 3 |
| 4. Being extremely aggressive with your supervisor or co-workers | 1 | 2 | 3 |
| 5. Talking to your supervisor or co-workers when they do not want to be bothered | 1 | 2 | 3 |
| 6. Expressing anger when your work is constructively criticized | 1 | 2 | 3 |
| 7. Allowing your emotions to affect your work | 1 | 2 | 3 |
| 8. Treating co-workers unfairly | 1 | 2 | 3 |
| 9. Taking full credit for a group effort | 1 | 2 | 3 |
| 10. Breaking company rules and policies | 1 | 2 | 3 |
| 11. Trying to be the first person out of the building after work | 1 | 2 | 3 |
| 12. Expressing superiority to your supervisor or co-workers | 1 | 2 | 3 |
| 13. Allowing comments or criticisms about your work to become personal | 1 | 2 | 3 |

| | Often | Sometimes | Never |
|---|---|---|---|
| 14. Indicating that you are more important than anyone or anything else concerned with your job | 1 | 2 | 3 |
| 15. Trying to gain personal advantages | 1 | 2 | 3 |
| 16. Asking your supervisor a lot of unnecessary questions | 1 | 2 | 3 |
| 17. Verbally or nonverbally telling your supervisor or co-workers that you are smarter or have a better education than they | 1 | 2 | 3 |
| 18. Taking problems to higher management rather than your immediate supervisor | 1 | 2 | 3 |
| 19. Being extremely sensitive to comments made by your supervisor or co-workers | 1 | 2 | 3 |
| 20. Making excuses when problems arise | 1 | 2 | 3 |
| 21. Complaining and finding faults with everything | 1 | 2 | 3 |
| 22. Blaming co-workers for your mistakes | 1 | 2 | 3 |
| 23. Doing personal tasks during work hours, such as reading magazines or writing letters | 1 | 2 | 3 |

| | Often | Sometimes | Never |
|---|---|---|---|
| 24. Being extremely critical of your supervisor, co-workers, or the company you work for | 1 | 2 | 3 |
| 25. Trying to learn co-workers' jobs before you know your own | 1 | 2 | 3 |
| 26. Complaining about anything associated with your job | 1 | 2 | 3 |
| 27. Watching the clock while working | 1 | 2 | 3 |
| 28. Ignoring safety rules | 1 | 2 | 3 |
| Totals | ______ | ______ | ______ |
| Grand total | | | ______ |

To see how well you are doing, total the score for the answers you marked. Check rating below.

75—84 points—*Excellent*. Keep up the good work and try harder on the few weak areas.

60—74 points—*Good*. Think of ways to overcome the weak areas.

45—59 points—*Fair*. Several areas need improvement. Decide which are most important and work on them first.

28—44 points—*Poor*. Quite a few areas need improvement. You need to develop a plan for overcoming weak areas.

NAME ______________________________

## EXPLORE HORTICULTURE JOB OPPORTUNITIES

**INTRODUCTION**

You are enrolled in a course of study that can provide you with an interesting, rewarding—often demanding—career. The horticulture field is full of opportunities for qualified people. The field offers jobs that involve a wide variety of skills and various working conditions.

When selecting a job or a career, a person must consider many questions that center around: Will the work and the pay, including benefits, be worth my while? In making that decision, a person may examine some of the factors listed below.

- How much will I actually earn?—This question is more than just asking how much your salary will be. Salary is just one consideration.

  You must also consider what your *take-home* pay will be. This is the amount you actually get when you pick up your check. Take-home pay will be less than your salary because of *deductions*. Money is deducted, or subtracted, from your pay for state and federal taxes and Social Security payments. These amounts are based on your salary and will be about the same no matter where you work (within the same state) if the salaries of the job are approximately the same. However, other deductions vary from job to job. For example, a payment for health of other insurance may be deducted. Similarly, the employee may be charged for union dues, uniform fees, work area or tool fees, a retirement program, or other costs. These will vary from job to job.

  When asking how much money you will earn, you must also ask how much money you will have to pay in order to work there. The cost may be, like a uniform expense, deducted from your paycheck or an expense paid from your pocket, such as what it costs you to drive to work.

You will also want to consider the value of *benefits* provided by the company. Benefits are those things a company gives to a worker other than salary, such as vacation time, paid holidays, sick leave, paid insurance, paid retirement funds, and others. Benefits may make the difference between which job actually pays better.

EXAMPLES: If two jobs pay the same salary but one offers one week of paid vacation while the other offers two weeks, you would actually have to work one week longer at the first job to earn the same salary.

In another example, if one employer pays for your health and life insurance while another doesn't, you will have to deduct what you have to pay for insurance when you compare salaries.

- Will the job be satisfying?—Will you be happy working at the job? If you have allergies, you probably would not be happy working in a floral shop. Landscape work can be dirty, physically exhausting, and mentally frustrating when you face a problem that appears to have no solution. On the other hand, the work can be very satisfying. You can have a feeling of accomplishment when you do a job well. You must also consider whether a job will help you to reach your goals—both personal and career goals.

This activity sheet will help you to explore job opportunities and career choices in horticulture. It consists of two parts. In the first part, you will consider your goals and how to reach them. In the second part, you will consider a specific job opening.

## PART I

**DIRECTIONS** Think about what your goals are in studying horticulture and then answer each item below.

1. Which of the following descriptions best describes your reasons for taking this course? (Circle the one that best applies).

   a. I am interested in a career in horticulture

   b. I just want to learn about working with plants.

   c. I am not sure whether I want to make horticulture a career, but I thought it might be interesting to check it out.

d. Horticulture is a stepping-stone to another career in which I am interested.

e. None of the above statements tell why I enrolled in the class.

2. From what I know about horticulture and myself, the occupational specialties in which I am most interested are ______. (Circle each one that applies).

   a. Floriculture

   b. Greenhouse management

   c. Fruit and nut production

   d. Vegetable production

   e. Interior plantscape

   f. Garden center

   g. Arboriculture

   h. Landscape management

3. From what I know about horticulture and myself, the occupational specialties in which I am definitely NOT interested are______. (Circle each one that applies).

   a. Floriculture

   b. Greenhouse management

   c. Fruit and nut production

   d. Vegetable production

   e. Interior plantscape

   f. Garden center

   g. Arboriculture

   h. Landscape management

4. My highest career goal is ______________________________.

   **NOTE:** If you do not know what your career goal is, you may go on to PART B.

5. To reach my goal, I plan to take the following schooling and work in the jobs listed.

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

## PART II

**DIRECTIONS**

Find an advertisement for a horticulture job opening. Obtain enough information about the job to answer the following questions.

1. What will be my take-home pay?

   Salaries and wages are often quoted by employers as gross earnings. Gross earnings are used because tax deductions vary according to the number of dependents, the amount of earnings, and other information.

   Optional benefits and deductions offered by an employer also differ. It is generally advisable to ask what programs are available for enrollment as these can affect the actual money you receive on payday.

2. What are the benefits that accompany the job? (List job benefits on the blanks below).

   Some benefits associated with working are not always visible. Often some of these overlooked benefits are paid for in part by your employer. At the time of the interview, or when considering a position, ask about employer's contributions for your protection, which may include

   - Health insurance
   - Unemployment compensation
   - Clothing and safety garments; cleaning of clothing
   - Medical facilities and health tests

- Pensions

  Travel insurance (covering mishaps when traveling on business)

- Training programs or reimbursement for courses related to job; certification training
- Sick leave with pay
- Paid vacations and holidays

_____________________________________________

_____________________________________________

_____________________________________________

_____________________________________________

_____________________________________________

3. How much will it cost to actually be at work each day?

   The costs associated with being employed are often overlooked. It may be of value to calculate estimated weekly expenses before you make a decision about a job.

   Estimate weekly expenses for the following.

| | |
|---|---|
| Transportation (parking, bus fares) | $_____ |
| Lunches (or cost of food eaten brought from home, including soft drinks and coffee) | $_____ |
| Clothing (including cleaning) | $_____ |
| Child care for working parent | $_____ |
| Tools | $_____ |

| | |
|---|---|
| Special uniforms, materials, or equipment for job | $____ |
| Other: Professional dues, employee funds, miscellaneous expenses | $____ |
| TOTAL | $____ |

4. What is important to me in a job?

Take-home pay and benefits may be only part of what you want from a job. Think through other things you consider important in a job.

What were three of the most rewarding things about any job you have ever had?

________________________________________

________________________________________

________________________________________

How might you rate the following items in order of importance to you? Number in order of importance the three items most important to you.

____ Job security (little chance you will be released from the job)

____ Opportunity for advancement

____ Recognition for your work

____ Good wages

____ Opportunity to learn and use your ideas

____ Flexible working hours

____ Long vacations

____ Pleasant working conditions

____ Interesting work

____ Friendly co-workers

____ Other

5. Are you ready to decide?

Take all of the information you have gathered and summarize it below and on the next page to reach a decision about whether you want the job or not.

a. Will the job be satisfying to me? Why/why not?

______________________________________________

______________________________________________

______________________________________________

b. What are the benefits that accompany the job?

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

c. What do I estimate job benefits to be worth?

$______________

d. How much will it actually cost me to be at work each day?

______________________________________________

______________________________________________

______________________________________________

e. What do I estimate my take-home pay to be?

$______________

f. What do I estimate my weekly expenses related to working to be?

$______________

g. How will the job meet my needs and goals?

______________________________________________

______________________________________________

______________________________________________

h. What would I enjoy most about this job?

______________________________________________

______________________________________________

i. What would I dislike most about this job?

______________________________________________

______________________________________________

NAME ______________________________

## OBTAINING A JOB

WRITE A LETTER OF APPLICATION FOR A JOB

**INTRODUCTION**

Your training is designed to help you find a job or to find a better job if you are already working. Whichever is the case, you will no doubt someday find a job for which you want to apply. There are several ways of finding out about job openings. You may see an advertisement in a newspaper or hear about the job from a friend or relative or you may be told about the job by a state or private employment agency.

Once you are aware of a job opening, you may have a choice of ways to apply for the job, unless the ad specifies "apply in person only" or some other approach. "In person" is one such approach. This means that you actually visit the company. More than likely, they will have you fill out an application and will either interview you then or will arrange an interview later if your application interests them.

Another way of applying for a job is to call the company. Often companies will list only a telephone number in their ads so that they can talk to applicants before they visit the office. In this way, they can screen applicants—that is, choose the ones they want to have come to the office.

Screening is also done through letters. Some companies require people to apply for jobs in writing, frequently by what is called a blind ad. A blind ad does not identify the company offering the job. A blind ad may give only an address, often a box number at the newspaper running the ad. Companies do this for various reasons. Sometimes they do not want their employees to know that a job is available, but more often it is just because they do not want a lot of people visiting or calling their office.

Horticulture jobs may require or allow any of the application methods discussed. Most will allow the applicant to apply in person. But many positions, especially advanced positions, will require a letter of application. Even if you plan to apply for a job in person, there are many reasons for writing a letter of application. First, a letter of application tells the employer that you are a prepared, organized person—something many employers look for when hiring workers. Second, a letter of application can be left with the employer after an interview or with a completed application form. The letter will help the employer remember you among the crowd.

Another advantage of a carefully prepared letter of application is what it can do for you personally. Writing such a letter will help you organize your thoughts. It will force you to think about your strengths and weaknesses in terms of the job. What you write in the letter may help if you are interviewed for the job. What you write in the letter may help you answer interview questions or make your answers clearer and better thought out.

This assignment sheet provides you with guidelines for preparing a letter of application. By following these guidelines and writing an application letter for any job in which you are interested, you will improve your chances of getting the job.

**DIRECTIONS**

Study the guidelines below and on the following pages and the sample letter on the last page. Then select a horticulture advertisement from a newspaper, one for which you would actually like to apply now or later in your training. On a separate piece of paper, write a letter of application for the job opening, following the guidelines in this activity sheet. You will discuss your letter with your instructor.

**NOTE:** This objective is not covered on the written test.

- Use acceptable form and appearance
- Type or write neatly
- Type or write on only one side of the paper
- Avoid smudges and typographical errors
- Use 8 1/2-by-11-inch white bond paper, not personal or fancy paper
- Spell, capitalize, and punctuate correctly
- Write employer's full name, title, and address
- Include on the letter your full name and address with zip code

- Keep a copy for future reference
- Include proper information
- Write to a specific person

  **NOTE:** Find out the name of the personnel manager/employer you want to reach and the correct title. When in doubt, write to the top person who will refer your letter to the right party. Write "To Whom It May Concern" if answering a blind ad.

- Avoid excessive use of the pronoun "I"
- State the position for which you are applying
- Avoid needless details
- Cover all points requested in the advertisement in exactly the order in which they were asked

  **NOTE:** Some prospective employers make a point of testing the applicant's ability to follow directions.

- State reason for interest in job

  **NOTE:** Employers look for people who want future advancement opportunities rather than just a paycheck.

- Request an interview at the employer's convenience
- Tell how you can be reached
- Make the letter upbeat, positive, and interesting
- Include the current date
- End the letter properly

  **NOTE:** Sincerely yours or Very truly yours is appropriate.

- Use your permanent address for the return address

219 Maple Street
Dayton, OK 77702
April 14, 1988

Ms. Sarah Miller, Owner
Miller Garden Center
Box 136
Collierville, OK 77708

Dear Ms. Miller:

Please consider me for the greenhouse job that you advertised in the *Daily Chronicle* on April 9. I will be graduating from Dayton High School in May. During the past two years, I have studied horticulture and will have completed the greenhouse course prior to graduation.

My training has included all the skills mentioned in your ad. The school will gladly provide you with a listing of my ratings for skills covered in the course. Additionally, my instructor, Mr. Hardin, can verify my skills and the fact that I am a fast learner and a safe worker with the kind of work attitudes you want.

I do not have the one year of work experience you specified in the ad. However, my training has emphasized hands-on experience, and I worked in a local garden center for almost three months last summer. I am confident that my training, limited experience, and dedication qualify me for the opening. I understand that you have hired graduates from our program and are familiar with the quality of training provided at Dayton High.

I meet the other qualifications that your ad specified, including familiarity with greenhouse watering equipment. A list of references is attached.

I would appreciate the opportunity to discuss the job at a time convenient for you. I can be reached at 405-555-4433 after 4:00 p.m. or at the address above.

Sincerely yours,

Terry McKracken

NAME ______________________________

## OBTAINING A JOB

EVALUATE INTERVIEWER'S REACTION

**INTRODUCTION**

Being interviewed is not always easy. You only have a few minutes to make a good impression. Your attitude, personality, and appearance, as well as your preparation for the interview and your work experience, are all points that the interviewer looks for and evaluates during the interview. It is up to you to sell yourself to the interviewer to convince this person that you are the one for the job.

**DIRECTIONS**

Read the following letter. Answer the questions that follow to evaluate this interviewer's reaction.

Dear Kerry,

Today you asked me for a job. From the look of your shoulders as you walked out, I suspect that you've been turned down before, and maybe by now you believe that people right out of high school can't find work.

But, I hired a teenager today. You saw her. She was the one with the clean hair, hands, and clothes, What was so special about her? Not experience, neither of you had any. It was her attitude that put her on the payroll instead of you. She wanted that job badly enough to dress for the interview, find out all she could about our company before coming in for the interview, and find out who was to do the interview. She did her best to impress me. That's where she edged you out.

I needed to hire someone who'd go out in the plant, keep her eyes open and work for me like she'd work for herself. If you have even the vaguest idea of what I'm trying to say, let it show the next time you ask for a job. You'll be head and shoulders over the rest.

Adapted from a letter contributed by
Brother "Friday" Fitzgerald

1. List the good characteristics of the teenager who was hired.

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

2. List Kerry's unsuitable characteristics.

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

3. **Why did the other person get the job?**

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

4. **What recommendations would you make to Kerry?**

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

NAME ______________________________

## PRACTICE DETAILED INTERVIEW QUESTIONS

**INTRODUCTION**

Interviews involve a question-answer situation. The interviewee is expected to answer many different questions. It is important for you to think before answering questions. Then be brief, positive, and honest in answering. The following are questions which might be asked when applying for various jobs. Use them as you practice going to an actual interview.

Questions concerning race, creed, color, national origin, sex, age, veteran status, handicaps, or disabilities cannot be legally asked during the interview process. Unfortunately, some employers continue to ask such questions. Answer such questions at your discretion as openly and honestly as possible.

**DIRECTIONS**

Think of a specific job that interests you, then answer the following questions. Write down brief answers in the spaces provided, and discuss with the class.

a. Where do you go to school? ______________________

When will you graduate? ______________________

b. What did you like best and what did you like least about the jobs or activities you have performed?

______________________________________________

______________________________________________

c. Do you have a handicap or health problem which would prevent you from performing the duties of the job?

______________________________________________

______________________________________________

d. At what salary do you expect to start? ____________________

e. Describe the training you have had and how you think it has prepared you for this job.

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

f. What are some of your social abilities pertinent to this position?

_______________________________________________

_______________________________________________

g. What skills do you possess?

_______________________________________________

_______________________________________________

h. What machines can you operate?

_______________________________________________

_______________________________________________

i. What personal characteristics do you think are needed to succeed in your vocation?

_______________________________________________

_______________________________________________

j. Is there an area in which you feel you need improvement or additional training in order to perform in this position?

_______________________________________________

_______________________________________________

k. Please describe your employment history. Include dates, wages earned, and reasons for leaving. Also include any voluntary or nonpaid activities which contributed to your experience history.

l. May we call or write your last employer?

m. How many people have you supervised at work or in organizations of which you are a member?

n. This job requires working one weekend per month. Would you be able to work this type of schedule?

o. How could you contribute to our organization?

p. Why should we hire you?

q. How do you feel about attendance and being on time for work?

r. Would you be willing to relocate? ____________________

s. When could you start to work? ______________________

t. Why would you like to work with this company?

u. Why do you want this job?

v. Is there anything else you would like to tell us about yourself?

w. Do you have any questions you want to ask us?

NAME ______________________________

Now that you are prepared for an interview, team up with another student in class. Assume the roles for interviewer and applicant, and then switch so that each of you gets to play both roles. Apply for the job you now have, for one you would like to have, or use the sample interview at the end of this activity sheet. Let your classmates evaluate your performance, using the job interview evaluation form below. Videotape the practice sessions if possible.

## JOB INTERVIEW EVALUATION FORM

### Preparing for the Interview

1. Were you clean, well groomed, and neat?
2. Did you wear appropriate clothes and shoes for the type of job for which you were applying?
3. Did you take an ink pen and résumé with the information you may need about social security number, references, addresses, dates employed, and dates attended school?
4. Did you go alone, not taking children, spouse, or friends with you?
5. Were you on time for the interview?
6. Did you know the name and title of the interviewer?
7. Did you know important facts about the employer, such as name, kind of business, products and services, reasons you want to work there, how old the company is, and where the plants, offices, or stores are located?
8. Were you prepared with appropriate questions?

   EXAMPLES: How many other people perform this job?
   Who will be my supervisor?
   Are there job advancement opportunities?

9. When you met the receptionist, did you smile, introduce yourself, state that you had an appointment, follow the receptionist's instructions, and wait patiently?

10. Did you enter with poise and greet the interviewer by name?

11. Did you shake hands firmly if the interviewer offered his or her hand?

12. Did you introduce yourself?

13. Did you seat yourself only at the interviewer's invitation?

14. Did you show signs of nervousness?

    NOTE: If you do not know where to put your hands, leave them on your lap and keep them still.

15. Did you not place personal things on the interviewer's desk, smoke, or chew gum?

16. Did you look alert, interested, and enthusiastic?

    NOTE: Sit slightly forward in the chair to give an alert appearance.

17. Were you confident and courteous?

18. Did you answer questions clearly?

19. Did you not interrupt the interviewer?

**Anticipating Employer's Questions and Volunteering Proper Information**

20. Did you avoid giving all "yes" and "no" answers?

21. Did you avoid criticisms of former employers?

22. Did you avoid talking about personal problems?

    NOTE: The interviewer will be interested in what you can contribute to the business rather than what the business can do for you. Do not use a sob story about how desperate you are for a job.

23. Did you show copies of your work if applicable?

## Closing the Interview

24. Did you watch for signs that the interview was over, such as the interviewer shuffling papers and moving around in the chair?

25. Did you ask, "May I say one thing more?" or "Would you be interested in...?" if the interviewer seemed to be ending before all important selling points had been made?

26. Did you thank the interviewer for the time and leave promptly?

## Following up the Interview

27. Did you write a follow-up letter, call, or visit again to express interest in the job and appreciation for the opportunity to interview?

Even if the interviewer does not offer the position, you should learn from every situation and try to improve your interviewing techniques.

## SAMPLE JOB INTERVIEW

**NOTE:** Two students may rehearse this script and read it in front of the class to show how an interview might be conducted.

A = Applicant

I = Interviewer

A (Enters room, pauses, smiles, and approaches Ms. Jones, whose hand is extended. They shake hands). Hello, Ms. Jones, I'm Joe Hunter, and I am applying for the job of florist designer which you advertised in Friday's *Daily Press*.

I Hello, Mr. Hunter. Won't you have a seat?

A Thank you. I have a résumé which may be helpful to you. (Hands Ms. Jones the résumés and sits down).

I This is a very well-prepared data sheet. Well, Joe, tell me about yourself.

A I'm a junior at Anytown High School where I'm enrolled in vocational horticulture. I'm interested in working in a business like yours while going to school. My older brother works in a greenhouse in Bug City, and I think there are a lot of future opportunities in this field.

I Joe, have you had any work experience; or are you presently working anywhere?

A Yes. I am working as a part-time floral assistant at Holiday Florists. I am responsible for keeping the walk-in stocked, as well as wiring flowers and taking and preparing some wire orders. I have also done floral arrangements for my relatives and neighbors.

I What do you think you have learned from your job at the florists?

A Probably the most important thing I have learned is how to deal with customers.

I What kind of person is your employer, and how do you get along?

A My employer has several good qualities. He offers very good service to the customers, and we get along well.

I Why do you want to leave?

A I feel there would be more opportunity for me to develop the skills necessary to reach my occupational objective in a business such as yours.

I How did you get the job at the florist?

A A friend of mine who used to work there recommended me as his replacement.

I When would you be able to start and what hours could you work?

A I could start work as soon as I give my present employer two weeks' notice. I will be able to work from 2:30 to 5:30 on weekdays and all day on weekends and holidays.

I In which school activities are you involved this year?

A I am a member of the FHA, student council, and glee club. I should know about any trips with these groups early enough to make arrangements with you and another employee so that there will be no problems with missing work.

I Do you have any financial obligations, such as a car payment?

A No, Ms. Jones.

I Have you ever had any difficulty with the police other than a traffic violation?

A No.

I How much do you expect to earn?

A I understand from some of the other employees that a person may begin at the minimum wage and advance with time and experience.

I That's right. Here is a brochure explaining our pay scale and other benefits.

A Thank you.

I Thank you for talking with us. We will let you know about the job soon.

A (Stands) Thank you for your time, Ms. Jones. Have a good day. (Shakes hands and leaves).

## ASSIGNMENT SHEET 1

## BEGINNING A CAREER IN HORTICULTURE

## II

NAME ________________________________ SCORE _______

**OBJECTIVE 11**

**Analyze work situations to determine the importance of employee attitudes.**

**INTRODUCTION**

The program in which you are enrolled is designed to teach you the knowledge and skills that you will need in the field of horticulture. However, surveys of employers repeatedly show that their workers' skills are generally good enough and that poor job knowledge is seldom a primary reason for an employer's being unhappy with a worker. Usually, the leading reason for such dissatisfaction is that the employee has poor work habits. Although this includes such things as tardiness and goofing off, more often it means not taking care of tools, working unsafely, showing disrespect toward customers or their property, not using common sense, and other attitudes and actions. In fact, one recent survey showed that the seven most important characteristics that employers seek in their workers are

1. Honesty
2. Reliability
3. Cheerfulness
4. Diligence
5. Enthusiasm
6. Cooperativeness
7. Loyalty

Many employers feel that a worker with good attitudes and good work habits can be taught the required skills, but that even the most skilled employee isn't worth keeping if he or she has a bad attitude or poor work habits.

**NOTE:** To check for competency in this objective, the test will be set up like this assignment sheet. You will be given three situations to analyze. To show mastery in this objective, you must correctly analyze 2 of the 3 situations.

**DIRECTIONS**

In this assignment, you will be given several situations and asked to identify the character trait or traits from the list above that is missing in the actions described. You will discuss this assignment in class or with your instructor.

1. There are many bags of potting soil in the garden center where Doug works. He sees nothing wrong with helping himself to a bag occasionally. He's sure that no one will miss it. Besides, he feels that it makes up for his not being paid enough. What's wrong with what Doug is doing? What future dangers exist if he continues this attitude?

2. Jill had a great time with her friends last night. She knew at the time that she should get home because of having to work the next day, but she was just having such a good time that she stayed out late. The following morning she had her roommate call in to the florist to say she was sick. Did she do the right thing?

3. Mac overheard the shop manager bawling out a co-worker, named Milan, for doing a poor job of pruning some shrubs, and threatened to fire him if it happened again. When Mac told Sergio about it they laughed because they consider Milan to be a nerd, even though Milan has tried to help each of them. What attitude problem exists and how do you think it affects the quality of work in the shop?

4. Mike works slowly and carefully and always does a good job on any task that is given him. But there are some jobs that he does not like to do. Whenever one of them is scheduled, Mike slows down even more or pretends that he has run into a problem until one of the other landscapers gets the next job. What do you think of what Mike is doing and what quality does he lack?

________________________________________________

________________________________________________

________________________________________________

________________________________________________

________________________________________________

5. Glenda dropped some electric hedge trimmers that she had been using. When she tried them again, they wouldn't work. She decided that she wouldn't report it because no one would know who did it after she returned the trimmers to the tool room. What did Glenda do wrong? How should she have handled the situation?

________________________________________________

________________________________________________

________________________________________________

________________________________________________

________________________________________________

6. Sonya never seems to be happy with things in the garden center. She complains constantly that other sales people tease her, that it is too hot or too cold or too dirty, that the computer isn't modern enough, that the customers are idiots, and so on. Her boss is especially worried because her attitude seems to be rubbing off on other workers. What do you think Sonya needs more of and what would you think if you had to work with a person like Sonya?

________________________________________________

________________________________________________

________________________________________________

________________________________________________

7. Ralph was out with some of his friends. He had a bad day and was angry about a couple of things that had happened at the nursery. As a result he began telling his buddies about how backward the management at his nursery is, how poorly qualified the workers are, and how they overcharge and cheat people. None of these things were true, and normally Ralph was proud of his nursery. What characteristic was lacking in Ralph's actions and how do you think he felt about his remarks later?

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

8. Felix is usually a good worker, but he is not very patient. If he is working on wedding flowers and things do not go smoothly, he gets upset. If things continue to go wrong, he is likely to give up on the task. Sometimes, he even takes shortcuts. For example, today he was having trouble getting all the roses wired in a bouquet, so he left out several roses and covered the spot with ferns. What is Felix's problem, and what further problems do you think it may lead to?

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**ASSIGNMENT SHEET 2**

## BEGINNING A CAREER IN HORTICULTURE

**II**

NAME ______________________________ SCORE ______

**OBJECTIVE 12**

**Write information needed on a résumé.**

Pretend you have graduated and have had some work experience. Be neat.

Résumé

Name __________________________ Telephone: __________

Address ________________________________________

________________________________________________

Employment objective

________________________________________________

________________________________________________

Work experience

________________________________________________

________________________________________________

________________________________________________

________________________________________________

________________________________________________

Volunteer experience related to job applying for

________________________________________________

________________________________________________

________________________________________________

Education

________________________________________________

________________________________________________

**Professional or Social Clubs**

______________________________________________

______________________________________________

**Additional information**

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**References (Persons who are familiar with your character or your work)**

______________________________________________

______________________________________________

______________________________________________

**ASSIGNMENT SHEET 3**

# BEGINNING A CAREER IN HORTICULTURE

**II**

NAME ______________________________ SCORE _______

**OBJECTIVE 13**

**Complete an employment application.**

**DIRECTIONS**

Complete the following application form using the guidelines below. Use information about yourself from your résumé.

**NOTE:** Although each facility uses its own form, general rules of preparation apply to any form.

- Be prepared
  - Take pen and pencil with you
  - Take copies of your résumé
- Look over entire form before starting to write; do not hurry
- Follow directions
  - Note whether information is to be printed or handwritten
  - Carry out all directions
- Write clearly, neatly, and legibly
- Answer briefly
- Be honest
- Answer all questions and fill in all blanks

  **NOTE:** If questions do not apply to you, write "NOT APPLICABLE" or "NA" in the space to show that you did not overlook the question.
- Include complete information; use résumé
- RECHECK application when finished
- Avoid cross-outs and obvious erasure marks
- Do not list any restrictions to the geographic area in which you would work unless you would absolutely not consider other geographic areas
- Use the word "OPEN" for questions about minimum salary since most employers pay standardized rates and will not negotiate on this

GREEN'S GARDEN CENTER
"An Equal Opportunity Employer"
2825 Greenlawn Drive
Somewhere, Oklahoma 14326
APPLICATION FOR EMPLOYMENT

Thank you for your interest in employment at Green's Garden Center. We are an equal opportunity employer and comply with the letter and the spirit of federal and state laws that prohibit discrimination based on race, color, creed, age, sex, national origin, or qualified handicap. We assure you that your application will be treated fairly and confidentially.

(Please type or print)

Date of Application ____________________

Name ____________________

Telephone Number __________ Social Security Number __________

Have you ever been employed at Green's Garden Center? __________

**Job Interest**

Position Applying for ____________________

Full-Time_____ Part-Time_____ Shift Preference__________

**Education and Training**

High School
Name ____________________ City/State _____

Did you graduate? __________ Receive G.E.D.? __________

College, University
Name ____________________ City/State _____

**Registration** (If Applicable)

List where you are currently registered

Registration/License ____________________
Certification Number Annual Number

City/State __________ Expiration Date __________

**Emergency Notification**

Name ____________________

Address ____________________ City/State/Zip _____

Telephone Number (Home) __________ Business) _____

**Special Skills**

List equipment and office machinery you can operate __________

____________________

**Employment History**

List your last three places of employment

Present or Last Employer ____________________ Position Held ________

Address ______________________ City/State/Zip ________________

Employed from______ to_____ Salary______ Supervisor _____________

Reason for Leaving ______________________________________________

Employer ____________________ Position Held __________________

Address ______________________ City/State/Zip ________________

Employed from______ to_____ Salary______ Supervisor _____________

Reason for Leaving ______________________________________________

Employer ____________________ Position Held __________________

Address ______________________ City/State/Zip ________________

Employed from______ to_____ Salary______ Supervisor _____________

Reason for Leaving ______________________________________________

**Military Service** (If Applicable)

Branch ______________________ Service Dates: From _____ to _____

Primary Duties ______________________________In Reserves? _____

**Personal Background**

Do you have any relatives employed at Green's Garden Center? ______

Do you foresee any problem (medical or other) that will cause your being absent from work on a regular basis? ______________________

**Recruitment Data**

What prompted you to apply for employment at Green's Garden Center?

Advertisement____ Career Day____ School____ Just Walked in ____

Relative/Friend____ Employee_____ Employment Agency _____

**Please Read Carefully**

I certify that the answers given in this application are complete and true and I authorize Green's Garden Center to investigate any or all statements made herein. I realize the falsification or omission of any information in this application or during any interview may be cause for immediate rejection or dismissal.

______________________________________________ ______

Signature Applicant Date

**ASSIGNMENT SHEET 4**

# BEGINNING A CAREER IN HORTICULTURE

**II**

NAME ______________________________ SCORE ______

**OBJECTIVE 14**

**Find and analyze job possibilities in a newspaper.**

1. Find two job opportunities that you could apply for after graduation. Use newspapers. Copy the job ads below.

   a. ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

   b. ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

2. On the blank provided write either "A" or "B" to designate one of the ads above that answers the following questions. If neither add applies write "O." You may write more than one letter in the blank.

   a. Which ad states that a driver's license is needed?______

   b. Which ad states that the fee is paid?______

   c. Which ad states that the applicant must call during specific hours?______

   d. Which ad has been placed by a firm outside the state of Oklahoma?______

   e. Which ad offers many benefits such as paid medical insurance, paid holidays, etc.?______

   f. Which ad offers profit sharing?______

g. Which ad requests résumés?______

h. Which ad states a need for mechanical experience?______

i. Which ad states that the applicant must apply in person? _____

j. Which ad states the application must have specific education requirements?______

k. Which ad asks for previous experience?______

l. Which ad indicates they will train you?______

**ASSIGNMENT SHEET 5**

## BEGINNING A CAREER IN HORTICULTURE

**II**

NAME ______________________________ SCORE ______

**OBJECTIVE 15**

**Prepare opening for a job interview.**

**NOTE:** It is important that you make a good impression during your entire interview. The impression you make with the secretary or receptionist may even be considered in deciding who gets the job. It is essential that you plan what you will say to the secretary or receptionist upon your arrival, and also what you will say when greeting the interviewer.

**PART I**

1. As soon as you arrive at the interview location, you should

   a. Go to the person in the office

   **NOTE:** This may be the secretary or receptionist.

   b. Introduce yourself

   c. State the purpose of your visit

   EXAMPLE: "Good morning. I'm Chris O'Neil, and I am applying for a job as tree pruner. I have a ten o'clock appointment with Ms. Green."

2. As your interview is started and you are greeting the interviewer, you should

   a. Greet the interviewer by name

   **NOTE:** You should have found out in advance the name and title of the interviewer and how to pronounce the name correctly.

   b. Introduce yourself

   c. State the purpose of your visit

   EXAMPLE: "Good morning, Mr. Smith. I'm Sally Wright, and I am here to apply for the position of groundskeeper."

**PART II**

Prepare what you will say to both the person in the office and the interviewer for each of the following situations. Use the space provided for your answers.

1. WANT AD

> Experienced interior plantscaper. Four-week training program in Dallas. Salary $650/month. Benefits with training. Sunny Interiors Company. 555-9420.

You have a 9:30 A.M. appointment with Ms. Harrison, regional manager.

a. Plan what you will say to the person in the office.

b. Plan what you will say when greeting the interviewer.

## WANT AD

| Entry level greenhouse worker. Dandelion Trail. 55-6374. |
|---|

You have a 1:30 appointment with Ruth Jordan, greenhouse manager.

If you do not know if a female interviewer is married, you should address her as Ms. unless she indicates that she would prefer to be addressed another way.

c. Plan what you will say to the person in the office.

d. Plan what you will say when greeting the interviewer.

**ASSIGNMENT SHEET 6**

## BEGINNING A CAREER IN HORTICULTURE

## II

NAME ________________________________ SCORE _______

**OBJECTIVE 16** **Practice basic interview answers.**

**DIRECTIONS** Circle the best answers to the following questions. You have three choices for each question.

1. How are you?
   a. Okay.
   b. All right.
   c. Fine, thank you.
2. Why do you want to work with this company?
   a. I think I would like the job.
   b. I don't know.
   c. I'm broke.
3. Have you ever done this type of work before?
   a. I don't remember.
   b. No, I ain't.
   c. No, but I would like to learn.
4. Are you able to work nights?
   a. No way.
   b. Yes, I am.
   c. Maybe.
5. When could you begin working?
   a. I don't know.
   b. It doesn't matter.
   c. Whenever you would like.

6. Do you have transportation to work?

   a. Uh-huh.

   b. I don't know, it depends on my husband.

   c. Yes, I do.

7. Would this salary be enough?

   a. No way.

   b. That would depend on my job duties.

   c. Are you kidding?

8. Can you do this type of work?

   a. I'd like to try.

   b. I guess so.

   c. We'll see won't we?

9. What skills do you have?

   a. What kind would you like me to have?

   b. I have worked with pruning equipment in peach orchards.

   c. You name it; I got it.

10. Who are your references?

   a. One is my teacher, Ms. Riley.

   b. What are references?

   c. I'm using my buddy, "Jeep" Wilson.

**ASSIGNMENT ANSWERS**

# BEGINNING A CAREER IN HORTICULTURE II

**ASSIGNMENT SHEET 1**

Answers should indicate a basic understanding of the way each situation violates one of the 7 most important characteristics employers seek in their workers as well as an understanding of the long-range implication of negative behaviors.

EXAMPLE: Stealing potting soil may lead to bigger thefts, such as stealing money from the cash drawer. Besides being fired, a thief may be prosecuted and jailed.

**ASSIGNMENT SHEET 2**

Résumé information should be complete and up-to-date as well as details. Make sure student has filled in all information.

**ASSIGNMENT SHEET 3**

Check to see student has filled in all questions. Check to see that information matches the information given in Assignment Sheet 2.

**ASSIGNMENT SHEET 4**

Check to see that students have found 2 different newspaper ads and have answered each question in Part 2 with either A, B, O or a combination of A and B.

**ASSIGNMENT SHEET 5**

Check to see that student responses display the following qualities:

- Politeness
- Proper grammar
- No slang
- Direct, clear, and specific information
- Address the person using their name or title, e.g. Thank you, Ms. Jones. Thank You, Dr. Evans.

**ASSIGNMENT SHEET 6**

1. c
2. a
3. c
4. b
5. c
6. c
7. b
8. a
9. b
10. a

**WRITTEN TEST**

# BEGINNING A CAREER IN HORTICULTURE

# II

NAME ______________________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with careers in horticulture to their correct definitions.** Write the correct letters in the blanks.

___ 1. Person who supervises greenhouse operations, including all business and horticultural activities

___ 2. Person who designs and constructs floral and plant arrangements

___ 3. Person who designs and constructs exterior landscapes to enhance and protect the beauty of the surrounding environment

___ 4. Person who practices the art or science of cultivating fruits, vegetables, flowers, and plants

___ 5. Person whose business is raising and selling fruits and nuts, cultivating and maintaining orchards

___ 6. Person whose business is cultivating and maintaining plants, trees, shrubs, bowers and turf.

___ 7. Person who designs and constructs interior landscapes to enhance the beauty of the surrounding environment

___ 8. Person who cultivates trees and shrubs, especially for ornamental purposes

___ 9. Person whose business is raising or selling flowers and ornamental plants

___ 10. Specialist in planting and transplanting, pruning, and diagnosing the ailments of trees in tree surgery and tree maintenance

a. Florist
b. Oleorist
c. Botonist
d. Groundskeeper
e. Agronomist
f. Horticulturist
g. Turfman
h. Floral designer
i. Orchardist
j. Pomologist
k. Arborist
l. Tree doctor
m. Tree surgeon
n. Interior plantscaper
o. Exterior plantscaper
p. Landscaper
q. Agriculturist
r. Greenhouse manager
s. Microbiologist
t. Arboriculturist

**OBJECTIVE 2**

**Recall the importance of personal characteristics that employers seek in employees by arranging a list in the same order as they are ranked by employers.** Write the correct answers in the blanks.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________

**OBJECTIVE 3**

**Select from the following list places to seek help in finding a job.** Write an "X" in the blank before each correct answer.

____1. Signs in windows of businesses

____2. Employment agencies

____3. Post office

____4. Friends and relatives

____5. School counselors

____6. Horticulture teachers

____7. newspaper ads

____8. Police offices

____9. Bus stations

____10. Past employers

____11. Bus drivers

**OBJECTIVE 4**

**Distinguish between the characteristics of private and public agencies.** Write the correct letters in the blanks. Letters may be used more than once.

___ 1. Charges a fee for service

___ 2. Charges no fees for service

___ 3. Requires an appointment

___ 4. Requires no appointment

___ 5 Offers specialized areas of employment

___ 6. Offers general areas of employment

a. Private

b. Public

**OBJECTIVE 5**

**Identify four places that hire horticulturists.**

______________________________

______________________________

______________________________

**OBJECTIVE 6**

**Arrange in order steps in a practical job-seeking plan.** Write a "1" in front of the first step, a "2" in front of the second step, and so on until complete.

___ Complete employment application forms

___ Participate in job interview

___ Obtain employment application forms

___ Write out a complete self-inventory

___ Evaluate a job offer

___ Write out a list of possible "contacts" to help you in your search

___ Arrange for an interview

___ Write a follow-up letter

___ Mail résumé and application forms

___ Prepare a résumé

___ Write out a list of employment possibilities

**OBJECTIVE 7**

**Distinguish between information to be obtained before and during a job interview.** Write "B" in front of information to be obtained before an interview. Write a "D" in front of information to be obtained during a job interview.

____1. If they have expanded or varied their operations

____2. Security and safety precautions

____3. Fringe benefits

____4. Opportunity for advancement

____5. How to pronounce the interviewer's name

____6. Products company makes or services they render

____7. Employee benefits and working conditions

____8. Who is doing the interviewing

____9. Salaries and/or wages

___10. Public relation

___11. Seniority

___12. What salary this job pays in similar settings

___13. How long they have been in business

**OBJECTIVE 8**

**Select from the following list the guidelines for dressing for an interview.** Write an "X" in the blank before each correct answer.

____1. Wear the latest fad

____2. Be modest and well-groomed

____3. Dress to fit the job for which you are applying

____4. Coordinate clothing

____5. Be conservative

____6. Wear strong colognes or aftershaves as your personal trademark

____7. Wear sunglasses during the interview

**OBJECTIVE 9**

**Select from the following list recommended interviewing practices.** Write an "X" in the blank before each correct answer.

___ 1. Greet the person interviewing you by name

___ 2. Chew gum to calm nerves

___ 3. Show a real interest in the job about which you are asking

___ 4. Be brief, positive, and honest in answering questions

___ 5. Shake hands if the interviewer extends the offer

___ 6. Take your mother to the interview

___ 7. Ask questions concerning the job at the end of the interview

___ 8. Maintain eye contact with interviewer

___ 9. Offer to provide the interviewer with any additional information

**OBJECTIVE 10**

**Select from the following list points the interviewer looks for during the interview.** Write an "X" in the blank before each correct answer.

___ 1. Experience

___ 2. Appearance

___ 3. Sex appeal

___ 4. Family background

___ 5. Personality

___ 6. Preparation

| | | |
|---|---|---|
| **NOTICE** | The following assignment sheets are not a part of the written test. If these activities have not been completed, check with your instructor. | |
| **OBJECTIVE 11** | **Analyze work situations to determine the importance of employee attitudes.** | SCORE ________ |
| **OBJECTIVE 12** | **Write information needed on a résumé.** | SCORE ________ |
| **OBJECTIVE 13** | **Complete an employment application.** | SCORE ________ |
| **OBJECTIVE 14** | **Find and analyze job possibilities in a newspaper.** | SCORE ________ |
| **OBJECTIVE 15** | **Prepare opening for a job interview.** | SCORE ________ |
| **OBJECTIVE 16** | **Practice basic interview answers.** | SCORE ________ |

## WRITTEN TEST ANSWERS

## BEGINNING A CAREER IN HORTICULTURE

## II

**OBJECTIVE 1**

1. r
2. h
3. p
4. f
5. i
6. d
7. n
8. t
9. a
10. k

**OBJECTIVE 2**

1. Honesty
2. Reliability
3. Cheerfulness
4. Diligence
5. Enthusiasm
6. Cooperativeness
7. Loyalty

**OBJECTIVE 3**

1, 2, 4, 5, 6, 7, 10

**OBJECTIVE 4**

1. a
2. b
3. a
4. b
5. a
6. b

**OBJECTIVE 5**

Answers should include any four of the following

- Greenhouses
- Florist shops
- Growers
- Government agencies
- Parks
- Golf courses
- Landscaping companies
- Orchard owners

**OBJECTIVE 6**

Answers should be numbered 1 through 11 in the following order

- Write out a list of possible "contacts" to help you in your search
- Write out a list of employment possibilities
- Write out a complete self-inventory
- Prepare a résumé
- Obtain employment applications forms
- Complete employment applications forms
- Mail résumé and application forms
- Arrange for an interview
- Participate in job interview
- Write a follow-up letter
- Evaluate a job offer

| | |
|---|---|
| **OBJECTIVE 7** | 1. B<br>2. B<br>3. D<br>4. D<br>5. B<br>6. B<br>7. D<br>8. B<br>9. D<br>10. B<br>11. D<br>12. B<br>13. B |
| **OBJECTIVE 8** | 2, 3, 4, 5 |
| **OBJECTIVE 9** | 1, 3, 4, 5, 7, 8, 9 |
| **OBJECTIVE 10** | 1, 2, 5, 6 |
| **OBJECTIVE 11** | **Refer to answers to Assignment Sheet 1.** |
| **OBJECTIVE 12** | **Refer to answers to Assignment Sheet 2.** |
| **OBJECTIVE 13** | **Refer to answers to Assignment Sheet 3.** |
| **OBJECTIVE 14** | **Refer to answers to Assignment Sheet 4.** |
| **OBJECTIVE 15** | **Refer to answers to Assignment Sheet 5.** |
| **OBJECTIVE 16** | **Refer to answers to Assignment Sheet 6.** |

**OBJECTIVE SHEET**

# HAND AND POWER TOOLS

# III

## INTRODUCTION

How effectively we work at our jobs depends on how well we can use our tools. Just as a good carpenter knows how to use his tools, horticulture workers, technicians, and specialists must know the right tool for the job and know how to use it safely and efficiently. Keeping tools sharp and maintained is a key to good craftsmanship in any career—you work faster and can do a better job when your tools are ready to use.

## UNIT OBJECTIVE

After completing this unit, the student should be able to identify hand and power tools and their uses, state safety rules for using tools and handling fuel, and know the proper maintenance and storage procedures for tools. The student should be able to operate and perform simple tasks with power equipment. The student will demonstrate these competencies by completing assignments sheets, job sheets, practical tests, and a written test with a minimum of 85 percent accuracy. Safety tests must be completed with 100 percent accuracy.

## SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with hand and power tools to their correct definitions.
2. State safety rules for using hand tools.
3. Match hand tools to their uses.
4. Select from a list characteristics of quality tools.
5. Complete procedures for maintaining hand tools.
6. Complete rules for storing hand tools.
7. Match correct use of the body with specific tools.
8. State fuel safety practices for power equipment.
9. State safety rules for operating power equipment.
10. State safety rules for operating electric power tools.
11. State safety rules for specific pieces of equipment.

12. Match power tools with their uses.
13. Explain hand-tool safety rules. (Assignment Sheet 1)
14. Identify hand tools. (Assignment Sheet 2)
15. Explain fuel safety rules. (Assignment Sheet 3)
16. Explain power tool safety rules. (Assignment Sheet 4)
17. Explain safety rules for operating electric power tools. (Assignment Sheet 5)
18. Explain safety rules for specific pieces of equipment. (Assignment Sheet 6)
19. Identify power tools. (Assignment Sheet 7)
20. Demonstrate the ability to
    a. Trim with an edger. (Job Sheet 1)
    b. Operate a front-tine rotary tiller. (Job Sheet 2)
    c. Operate a rear-tine rotary tiller. (Job Sheet 3)
    d. Mix soil medium with a cement mixer. (Job Sheet 4)
    e. Operate a gasoline-powered backpack mist blower. (Job Sheet 5)

## SUGGESTED ACTIVITIES

## HAND AND POWER TOOLS

## III

### PREPARATION

- Order materials to supplement unit.

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Review teaching suggestions and plan classroom activities.

- Determine how you will schedule time for students to demonstrate competence in the required procedures.

- Determine scheduling for preparing for and taking safety tests.

- Determine whether to divide the unit or treat it as a whole. The unit consists of two distinct parts:

  - Objectives 2 through 7: Hand tools, hand tool safety, hand tool maintenance and storage; Assignment Sheets 1 and 2: Safety test and tool identification

  - Objectives 8 through 20: Power tools, power tool safety, fuel safety; and Assignment Sheets 3 though 7: Safety tests and tool identification; Supplement 1: Gas Tools vs. Electric Tools; and Supplement 2: How to Till a Garden Plot.

- Invite a chiropractor or osteopath to lecture on back and muscle injuries and to demonstrate proper techniques for handling hand and power tools.

- Invite a Fire Safety Education Officer to visit the class to discuss fuel safety, power and electrical tool safety.

- Invite experienced gardeners or landscape maintenance managers to demonstrate and discuss operating tillers, edgers, hedgers and weed cutters.

  **NOTE:** Supply guest speakers with the Objective Sheet, Information Sheet and any other components you want them to cover.

## DELIVERY

### Objective 1

- Review terms and definitions to be sure students understand them.
- Stress safety. Discuss your own experiences and others you have heard about involving misuse of tools, carelessness, poor maintenance, etc.

### Objective 2

- Stress that safety tests must be passed with 100% competency.
- Elaborate on each safety rule and reinforce it with examples, personal experience, or hypothetical cases.
- Have students complete Assignment Sheet 1, *Explain hand tool safety rules*.

### Objective 3

- Demonstrate the proper use of each tool, supervise student practice.
- Demonstrate potential accidents and discuss how to avoid injury.
- Have students complete Assignment Sheet 2, *Identify hand tools*.

### Objective 4

- Encourage students to visit gardening supply houses or hardware stores and compare tools for price and quality.
- Share with students how you selected the tools for your program, what choices you might have made with an unlimited budget, and what new models and tools you would buy now if you could have the ideal hand tools.
- Share with students mistakes you have made in selecting hand tools in the past.

### Objective 5

- Discuss the cost of hand tools and how rust and poor maintenance or improper storage can damage tools.
- Demonstrate how to remove rust and discuss or demonstrate how you keep tools sharp.

**NOTE:** If you sharpen your own tools and encourage students to use a grinder, obtain a unit of instruction from the State Department on how to sharpen tools.

### Objective 6

- Have students evaluate your tool storage system, their home tool storage system, and make recommendations for improvements.
- Have one group of students rearrange the tool storage area or remove all tools and another group replace them in correct order. Then have teams switch jobs. Reward the team that demonstrates the best knowledge of proper storage.

### Objective 7

- Show 18-min film, *Danger Zone: Your Back.*
- Discuss your own injuries or examples you have seen of students or experienced gardeners with knee problems, back problems, arm and shoulder joint problems related to gardening.
- Demonstrate the proper ways of working with long-handled tools.
- Have a chiropractor or osteopath discuss how to use muscles and tools correctly and avoid strain or injury.

### Objective 8

- Review fuel safety practices and share personal experiences you have witnessed or heard about regarding mishandling of fuels, underestimating the potential danger, and examples of careful handling.
- Have students complete Assignment Sheet 3, *Explain fuel safety rules.*
- Have a Fire Safety Education Officer discuss and demonstrate fuel safety practices.

**Objective 9**

- Show 11-min film, *It's Up to You* or other safety film.
- Share with students examples of power tool accidents and examples of careful handling.
- Have students complete Assignment Sheet 4, *Explain power tool safety rules.*

**Objective 10**

- Show 30-min film, *Electrical Safety.*
- Share with students examples of accidents and injury related to electric tools and examples of careful use.
- Distribute Supplement 2, *Gas and Electric Tools: Pros and Cons.*
- Have students complete Assignment Sheet 5, *Explain safety rules for operating electric power tools.*

**Objective 11**

- Show 17-min. film, *An Option to See.*
- Discuss the potential dangers in operating tillers, weed cutters, edgers, backpack mist blowers, lawn mowers and chipper/shredders.
- Have students complete Assignment Sheet 6, *Explain safety rules for specific pieces of equipment.*
- Distribute Supplement 2, *How to till a garden.*

**Objective 12**

- Show tools to students and demonstrate their use and safety procedures.
- Make operating manuals available as needed. Indicate how to find out information in the manual and stress safety warnings and cautions.
- Have students complete Assignment Sheet 7, *Identify power tools.*

**APPLICATION**

**Objectives 13 through 20**

- Use Assignment Sheet 1, *Explain hand-tool safety rules* to allow students (1) to practice writing the safety rules that will be on the test (2) to think about and explain the rule and (3) to visualize the potential dangers if the rules are not followed.

- Use Assignment Sheet 2, *Identify hand tools*, to insure that students can identify hand tools from their pictures. You may want to provide the actual tools at the time students are completing the assignment sheet. You may want to add tools used in your program that are not included in this unit.

- Use Assignment Sheet 3, *Explain fuel safety rules* to allow students (1) to practice writing the safety rules that will be on the test (2) to think about and explain the rule and (3) to visualize the potential dangers if the rules are not followed.

- Use Assignment Sheet 4, *Explain power tool safety rules*, to allow students (1) to practice writing the safety rules that will be on the test (2) to think about and explain the rule and (3) to visualize the potential dangers if the rules are not followed.

- Use Assignment Sheet 5, *Explain safety rules for operating electric power tools*, to allow students (1) to practice writing the safety rules that will be on the test (2) to think about and explain the rule and (3) to visualize the potential dangers if the rules are not followed.

- Use Assignment Sheet 6, *Explain safety rules for specific pieces of equipment*, to allow students (1) to practice writing the safety rules that will be on the test (2) to think about and explain the rule and (3) to visualize the potential dangers if the rules are not followed.

- Use Assignment Sheet 7, *Identify power tools*, to have students demonstrate that they recognize and can label pictures of tools. You may want to add tools in your program that are not included in this unit.

- Use Job Sheets 1 through 5 to test student competency in operating equipment:

  Job Sheet 1—Trim with an edger

  Job Sheet 2—Operate a front-tine rotary tiller

  Job Sheet 3—Operate a rear-tine rotary tiller

Job Sheet 4—Mix soil medium with a cement mixer

Job Sheet 5—Operate a backpack mist blower

## EVALUATION

### Practical Test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

### Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

### Audiovisual Materials

- *Electrical Safety*. 16mm color film, 30 min, 1983, Tel-a-Train. Stresses the importance of safety procedures when working with electricity. Explains the path that electricity follows. Addresses what happens when a person intercepts that path and the damage it can cause. Order no. F112.
- *Danger Zone: Your Back*. 16mm, color film, 18 min., 1981, Visucom Productions. Safety film demonstrating good lifting, pulling, and pushing practices to motivate employees to participate in accident prevention. Order no. F171

- *An Option to See*, 16mm color film, 17 min, 1977, Oklahoma Society to Prevent Blindness. Stresses the importance of wearing safety glasses while working around machinery. Order no. F166.

- *It's Up to You*. 16mm Color, 11 min, 1960, Harvest Films, Inc. Award-winning breakthrough film on eye safety. Order no. F167.

  **NOTE:** These films are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074, 1-800-522-5810.

- *Push Mowers*. Vol. 1 of *Equipment Safety Videos*, Color VHS, 30 min, The Idea Bank. Covers 2-cycle and 4-cycle mowers, refueling, hazards, proper clothing and protection, safety tips. Available by name from The Idea Bank, P.O. Box 23994, Tempe, AZ 85285, telephone 1-800-621-1136, FAX order number (602) 921-0441.

- *Power Hand Tools*. Vol. 2 of *Equipment Safety Videos*, Color VHS, 30 min, The Idea Bank. Covers how to safety inspect and operate hedgers, blowers, grass and weed cutters, chain saws, how to choose the right tool for the job, clothing safety tips. Available by name from The Idea Bank, P.O. Box 23994, Tempe, AZ 85285, telephone 1-800-621-1136, FAX order number (602) 921-0441.

**UNIT REFERENCES**

- *Horticultural Occupations*, College Station, Texas: Texas A & M University, Instructional Materials Service, 1985.

- Smith, Carol A. *Landscape Management: Field Operator*, Stillwater, Oklahoma: The Mid-America Vocational Curriculum Consortium, Inc. (MAVCC), 1988.

- Williams, Jeff T., *How to Select, Use & Maintain Garden Equipment*, Ortho Books, San Francisco: Chevron Chemical Company, 1981.

**OBJECTIVE 1**

**Match terms associated with hand and power tools to their correct definitions.**

- **Prune**—To cut dead or living parts from a plant in order to increase fruit or flower production, to improve the form or to remove dead or diseased parts
- **Work**—To till or turn the soil
- **Cultivate**—To break up and loosen the soil
- **Beveled**—Edges are angled to create a sharp cutting surface

  **NOTE:** The smaller the angle, the sharper the edge.

  FIGURE 1

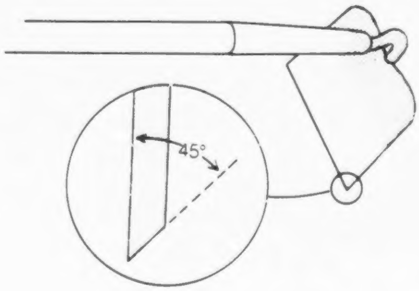


Illustration reprinted with permission of Ortho Books, © 1981.

- **Burr**—Sharp particles left on edges after filing or sharpening
- **Degree of cant**—Position of a shovel or spade blade in relation to the handle

  **NOTE:** The greater the degree of cant, the more leverage the tool will have in lifting. A lesser degree of cant is best for digging straight down the sides of a hole.

FIGURE 2

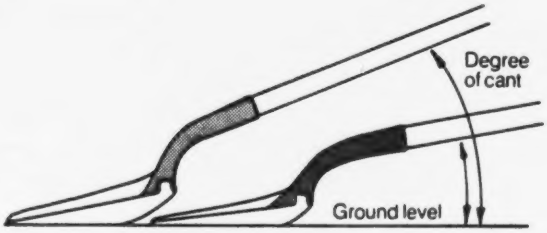


Illustration reprinted with permission of Ortho Books, © 1981.

- **Conductor**—Material that allows electricity to flow through it

  EXAMPLES: Metals and water

- **Insulation**—Material that will not allow electricity to flow through it

  EXAMPLES: Rubber, porcelain, glass, resin, cotton and some plastics

- **Head**—Metal working part of a hand tool attached to the handle

  EXAMPLES: Rake, shovel, spade

**OBJECTIVE 2** **State safety rules for using hand tools.**

NOTE: Never underestimate the potential for accidental injury. Improper use of hand tools can cost you pain or discomfort and time away from work.

- Always use a tool as it is designed to be used
- Stay alert any time you use tools
- Keep tools in their proper places
- Do not leave tools on the floor or on the ground near work site
- Put tools down with tines facing into the ground

NOTE: If a person steps on the tines of a rake, the handle will hit the face and can cause broken facial bones and eye injuries. Tines of a hand cultivator can penetrate shoes and feet.

- Inspect tools before use and often during use

NOTE: Always check tools head for tightness and tighten loose heads before working. Check tools with screws or bolts often during use and tighten as needed.

- Keep cutting edges sharp

NOTE: Dull edges require more force to cut and added pressure can cause accidental slips and injuries.

- Store sharp or pointed tools in a place where you will not stab yourself with them

**WARNING Do not put hand pruners, knives, or scissors in pants pockets.**

- Hold pruners and loppers straight while cutting; twisting will damage tools and plants
- Locate all underground utility lines and pipes before digging
- Wear appropriate clothing for the job

EXAMPLES: Wear leather-soled shoes for digging, not tennis shoes, wear hard-toed shoes when using tines or hoes.

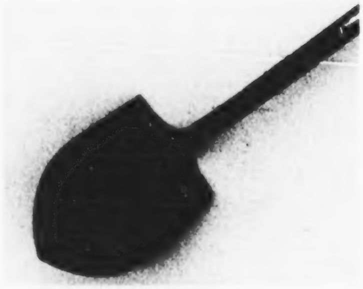
**OBJECTIVE 3** **Match hand tools to their uses.**

NOTE: The degree of cant on shovels and spades and the angle on rakes, forks, hoes and cultivators determines their most efficient uses, such as pulling, chopping, lifting, digging straight or at an angle.

- **Pointed shovel**—Used for digging in hard soil or roots; with a moderate cant, can also be used to move or carry soil

NOTE: The rounded lips at the top of the blade allow the user to push the blade into the ground with a foot.

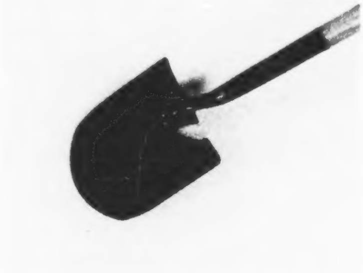
FIGURE 3



- **Round-nose shovel**—Used for digging, lifting loose sand and soil, scooping and preparing planting holes

**NOTE:** The round-nose or round-end shovel is the most common, all-purpose shovel.

FIGURE 4

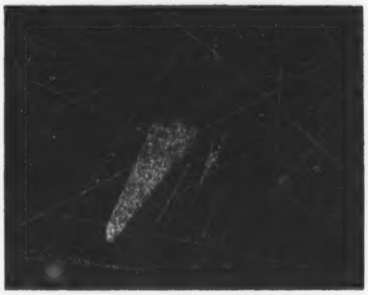


- **Square-nose shovel**—Used for lifting heavy materials such as sand, gravel, concrete and rocks

FIGURE 5

- **Scoop shovel**—Used for lifting larger quantities of light materials such as mulch, sawdust, soil mix, snow, and light trash

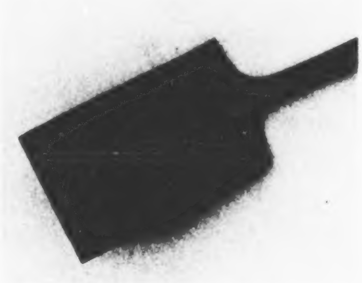
FIGURE 6



- **Spade**—Used for cutting soil, digging trenches with straight sides, digging narrow holes for planting trees and shrubs, and for cutting turf

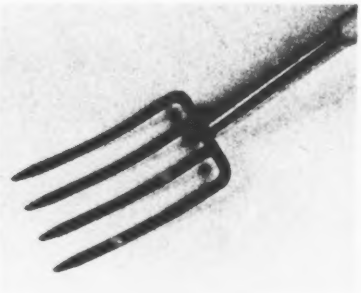
NOTE: Spades have a smaller degree of cant than shovels and a sharp edge for cutting. Spades are designed with flat, rounded and pointed noses for different applications and are available with long handles, D-shaped handles, and T-shaped handles.

FIGURE 7



- **Garden fork**—Used to turn soil in lawn and garden areas

FIGURE 8

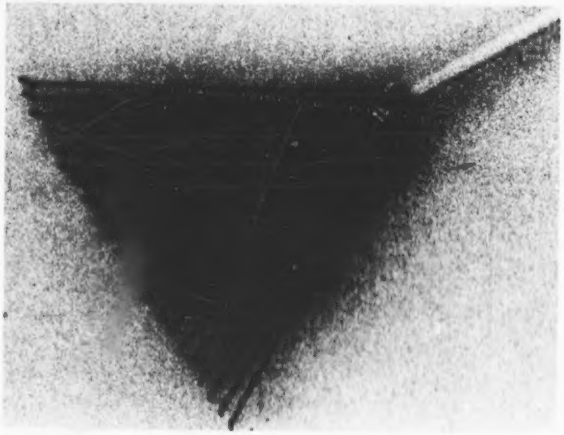


- **Hand trowel**—Used for digging holes, filling and covering around single plants

FIGURE 9

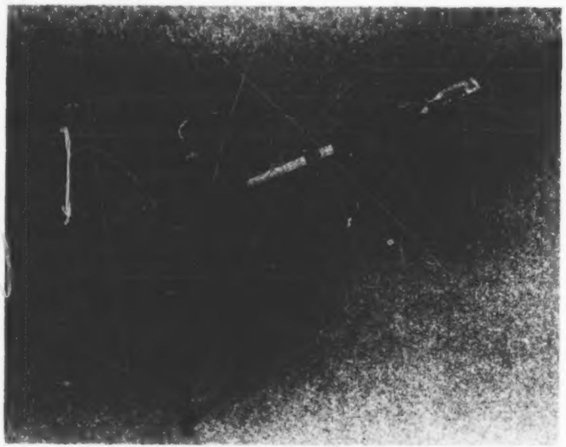
- **Garden rake**—Used for leveling a garden or lawn area

FIGURE 10



- **Leaf rake**—Used to gather fallen leaves, collect grass cuttings, and to mix lime, fertilizer, and grass seeds into newly seeded lawn areas

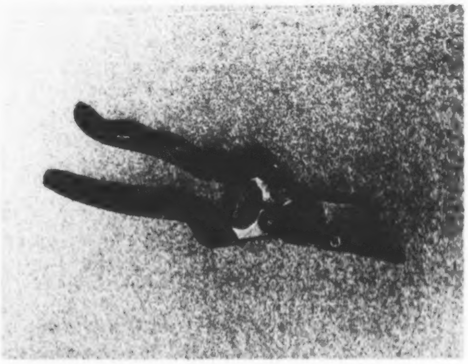
FIGURE 11



171

- **Hand pruner**—Used to prune small branches no larger than a pencil

FIGURE 12



- **Hedge shears**—Used for trimming and shaping hedges and simple pruning jobs

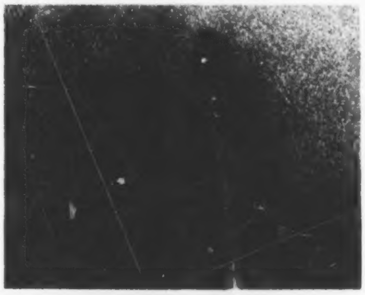
NOTE: See power tool section for gasoline or electric hedge trimmers.

FIGURE 13

- **Lopping shears (loppers)**—Used for pruning branches from pencil-size to 1 1/4 inch in diameter

NOTE: Aluminum, steel, fiberglass, and wooden handles are available but steel and wood are more durable. Select loppers with rubber pads on the inside of the handle to act as shock absorbers.

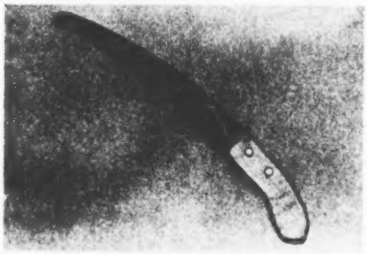
FIGURE 14 (lopping shears)



- **Pruning saw**—Used to remove branches larger than 1 1/4 inch in diameter.

  NOTE: May have double-edge blades with small teeth on one edge and larger teeth on the other for use on smaller or larger branches. Pruning saws are available in curved, straight blade and folding models.

  FIGURE 15



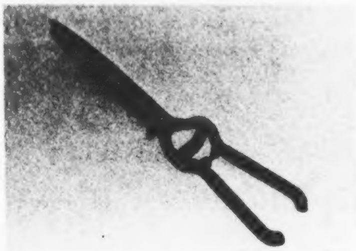
- **Bow saw**—Single-edge blade used for removing small-diameter tree limbs

  FIGURE 16

- **Grass clippers**—Used to trim grass and weeds growing around small trees and seedlings

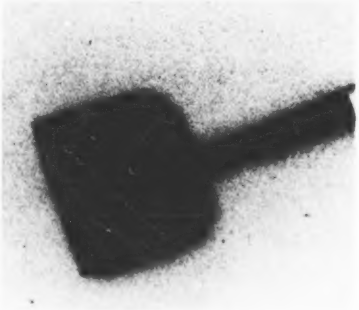
NOTE: Power weed cutters are in common use for trimming around large structures such as trees, foundations, sidewalks and fences.

FIGURE 17 (grass clippers)



- **Long-handled edger**—Used to separate one growing area from another

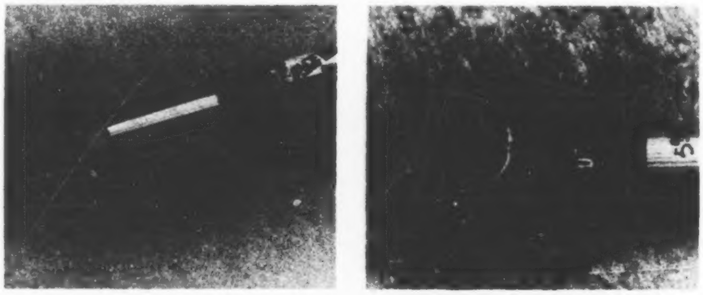
FIGURE 18



- **4-tine or 3-prong cultivator**—Used for weeding and cultivating around shrubs, flowers, and vegetables

NOTE: The 4-tine cultivator is also called a potato fork. The 3-prong cultivator may have a long or short handle.

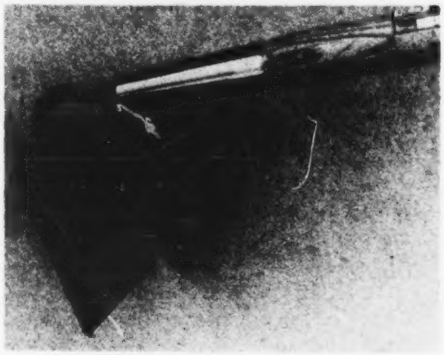
FIGURE 19



a. 4-tine cultivator     b. 3-prong cultivator

- **Garden hoe**—Used for weeding and leveling soil in a flower or vegetable garden

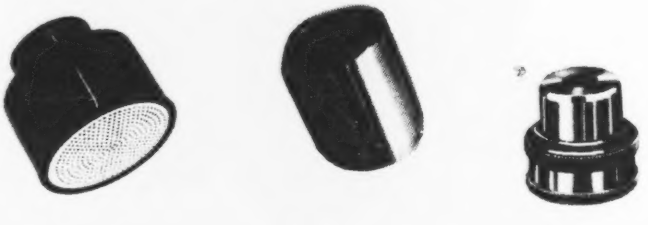
FIGURE 20



- **Water breakers**—Used to apply a gentle, uniform spray of water to surface areas containing seedlings, cuttings, or plants

  **NOTE:** Breakers deliver a high volume of water without causing erosion by bubbling or breaking the water into small droplets. The largest breaker is for general watering, a finer spray is used to water tender seedlings, a very fine spray for seedbeds and the smallest calibration is for misting.

FIGURE 21



a. Breaker b. Bubbler c. Mist head

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Wand**—Used to water hanging baskets and areas out of reach

  **NOTE:** Wands are fitted with breakers to control the spray.

FIGURE 22 (wand)

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Dibble**—Used to make a small hole in soil mix to plant seeds or transplant seedlings

FIGURE 23

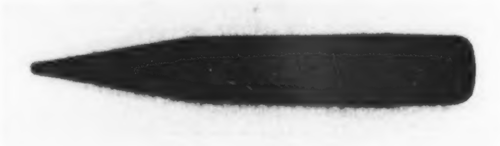


Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Knife**—Used for cutting, trimming and thinning

FIGURE 24

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Bulb planter**—Used for making holes and removing soil to plant fall bulbs

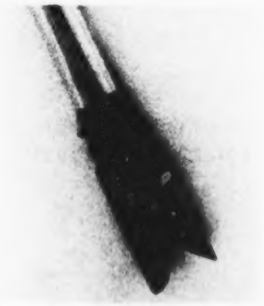
FIGURE 25

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Post hole digger**—Used for digging deep, narrow holes to plant trees and shrubs

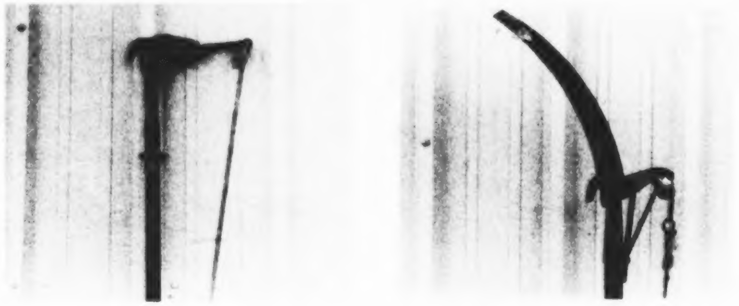
**WARNING Handles come together quickly and can injure knuckles. Use caution when digging.**

FIGURE 26



- **Pole pruner and saw**—Used to remove branches that are out of reach

FIGURE 27

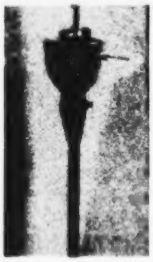


a. Pruner

b. Pruner and saw combination

- **Root feeder**—Sharp, pointed hollow pole that sticks into the ground and supplies nutrients and minerals to the roots of a plant

FIGURE 28 (root feeder)



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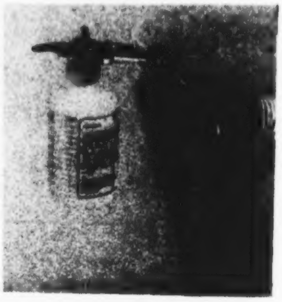
- **Hose-end sprayer**—Container attached to the end of a hose to supply measured amounts of liquid fertilizer or pesticides to plants

FIGURE 29



- **Compressed-air sprayer**—Used to apply fertilizers, herbicides and pesticides in borders, gardens, and medium-size lawns

NOTE: Sprayers are available in manual and power models and for applying highly-concentrated chemicals.

FIGURE 30

a. Hand model

b. Backpack model

**OBJECTIVE 4**

**Select from a list characteristics of quality tools.**

**NOTE:** Tools are meant to be used for specific jobs. "The right tool for the job" makes the job easier and faster and protects the tool from damage caused by misuse.

- **Durability**

  a. Handles are made of rolled steel, fiberglass, or smooth *hardwood* such as hickory or ash

  b. Reinforced handles and head are meant for heavy use

  c. Metal heads are made of stainless or forged steel in one piece

- **Efficiency**

  a. Cutting edges are sharp and will hold an edge after sharpening

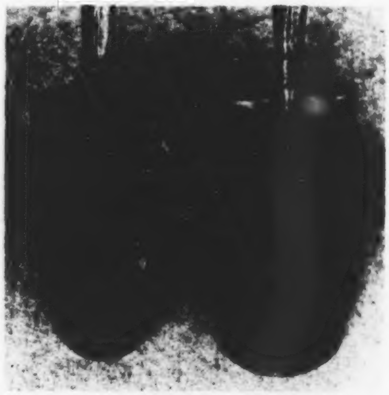
  b. Moving parts work smoothly

- **Construction**

  a. Heads are attached tightly by closed socket

  **NOTE:** Open sockets are common because they are cheaper to manufacture. Closed sockets are stronger than open sockets, will carry heavier loads and last longer.

  FIGURE 31



  **Open Socket** **Closed Socket**

  b. Grains of wooden handles run in the same direction as the force exerted on the tool

c. Saw teeth are beveled to provide a good cutting edge

d. Cutting edges have no nicks or burrs

e. All screws and bolts are placed correctly and securely

**OBJECTIVE 5** **Complete procedures for maintaining hand tools.**

- Keep tools clean
- Keep tools free of rust

  NOTE: Remove rust with a scraper or steel wool and a rust remover. Dry thoroughly, oil, and store properly.

- Check tools often and tighten or replace screws, bolts, handles, and heads as needed
- Sharpen or replace dull cutting edges
- Repair broken or damaged tools promptly
- Dispose of broken tools that cannot be repaired
- Keep moving parts oiled
- Oil wooden handles with linseed oil to prevent drying and splitting

**OBJECTIVE 6** **Complete rules for storing hand tools.**

- All tools must be stored clean and dry
- Keep tools in their proper places

  NOTE: Hunting for tools that have been stored in the wrong place is frustrating and wastes valuable working time.

- Cutting edges should be protected

  EXAMPLE: Tool such as hoes and spades should be hung on a wall or stored with the handle, not the blade, on the ground.

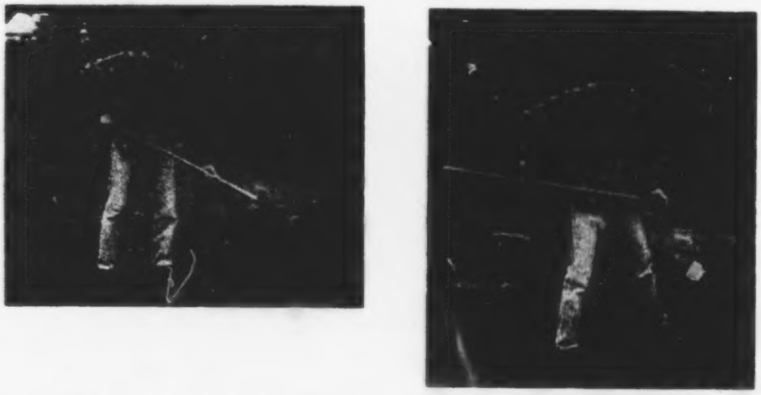
- Tools should not be placed where they can roll off benches or tables
- Large tools should be placed out of the path of traffic

- Hand tools, especially those with sharp edges, should be hung rather than stored in a drawer or on a shelf

**OBJECTIVE 7** **Match correct use of the body with specific tools.**

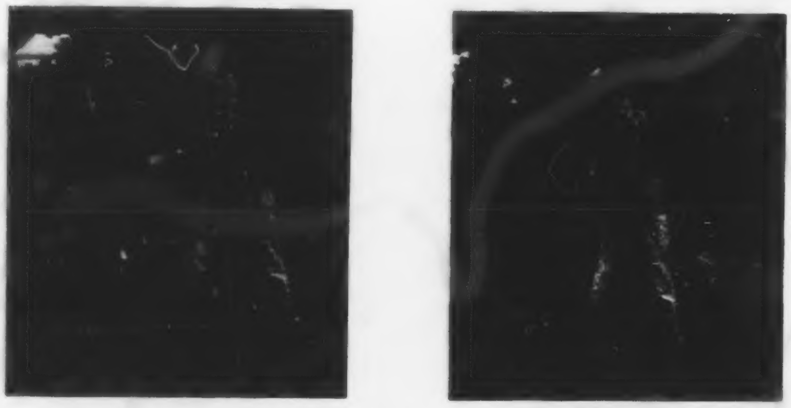
- **Shovels**—Avoid back injury: do not try to lift loads that are too heavy; use legs and wrists rather than twisting the back

FIGURE 32



a. **WRONG**—Back is bent and rounded, knees are locked; shovel is held away from body

b. **RIGHT**—Back is straight, knees bent; shovel held close to the body

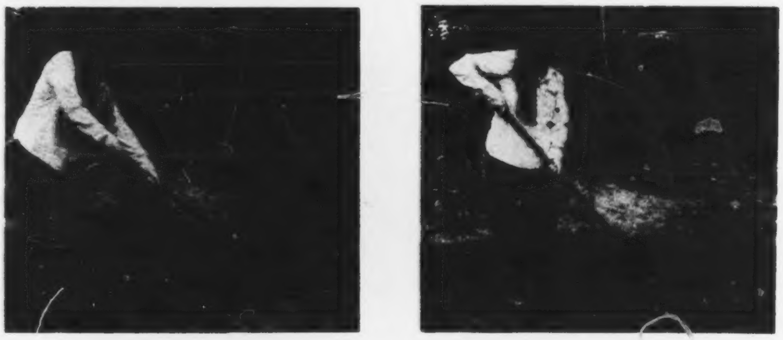


c. **WRONG**—Feet face front and upper body is twisted to dump soil to the side.

d. **RIGHT**—Feet and shoulders are turned, wrists rotate downward to dump soil

- **Rakes and long-handled cultivators**—Use short strokes to avoid back strain and strained joints

FIGURE 33

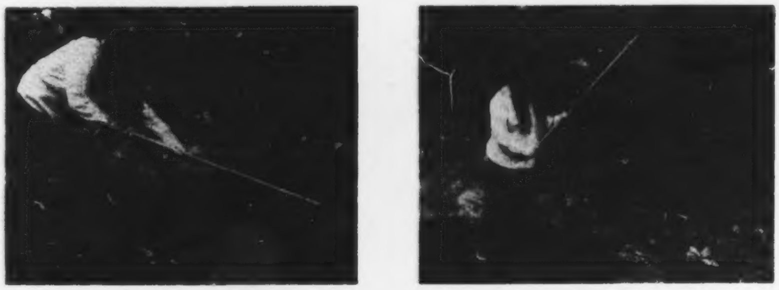


a. **WRONG**—Reach is too long; shoulder, elbow and wrist are strained by hard pulling

b. **RIGHT**—Joints can be used in moderate pulling

- **Hoes**—Raise hoe high and let its own weight carry it into the ground, rather than using force with arms and back; use short strokes to cut weeds and loosen clods

FIGURE 34



a. **WRONG**—Shock is absorbed by elbows and back, joints are strained

b. **RIGHT**—Raise hoe and let it fall; pull hoe in short strokes

**OBJECTIVE 8**

**State fuel safety practices for power equipment.**

- Mix and pour fuels outdoors
- Use only fuel or fuel mixture recommended for each tool

  EXAMPLE: Do not use gasoline in a diesel engine, or gasoline only in an engine requiring a gas/oil mix.

- Never smoke while mixing and pouring fuels
- Use only approved fuel containers
- Never store fuel indoors where fumes can be ignited by a flame or spark
- Wipe up all spills on machinery and drives

  NOTE: Sparks from an electric motor or a pilot light can ignite fumes from a gas can.

- Move away from a spill area, wipe off excess fuel and allow fuel to evaporate from equipment before starting the engine
- Never remove the gas cap or add fuel when the engine is running or hot
- Always allow the engine to cool before transporting or storing a tool

  NOTE: Muffler and exhaust get very hot. Avoid touching or getting too close to these parts.

- Empty the fuel tank before storing a tool
- Operate equipment only in a well-ventilated area

**OBJECTIVE 9**

**State safety rules for operating power equipment.**

NOTE: "Safety First" means thinking and concentrating *before* you operate equipment.

- Read, understand and follow the warnings and instructions in the operating manual before using any tool; know all controls and how to operate them

  NOTE: Do not use any tool until you understand how to operate it.

- Know how to start and stop machine before operating

- Review manuals at the beginning of each season
- Check machine and make all adjustments *before* turning on the power

  **NOTE:** Check oil and fuel levels every time you use the equipment.

- Check safety shields and keep them in place during operation
- Never operate power equipment when you are tired, ill, or under the influence of alcohol, drugs, or medications
- Make sure there are no people or animals in the operating area or where materials or objects might be thrown

  EXAMPLES: Grass cuttings or mist blower spray

- Remove all debris from the area before operating

  **NOTE:** Especially watch for objects that could catch in the mechanism or cause injury if thrown: sticks, wires, rocks.

- When engine is shut off, wait for moving parts to stop before handling machine
- Do not leave a running machine unattended
- Turn off equipment immediately when it overheats
- Stop engine and disconnect spark plug wire before cleaning, fueling, or making adjustments
- Keep hands, feet and clothing away from moving parts
- Always wear heavy, long pants and boots

  **WARNING Always wear heavy shoes or boots to operate a tiller, weed cutter, mower, edger or other ground-cutting equipment. Ankles should be protected as well. These machines throw rocks, broken sticks and sometimes broken blades and can cause serious injury. Never wear sneakers or sandals.**

- Wear gloves, safety glasses and ear protection when needed

  **NOTE:** Safety goggles or face shields are needed when operating equipment that can throw rocks, sticks, or other solid objects. Wear dust mask in windy, dusty conditions or if you suffer from hay fever.

- *Do not wear gloves* when hands are near moving parts

EXAMPLE: Hedgers

- Remove jewelry and tie long hair back
- Wear close-fitting clothing

NOTE: Loose clothing, jewelry, and long hair can become caught or tangled in moving parts.

**OBJECTIVE 10** **State safety rules for operating electric power tools.**

NOTE: Most accidents and injuries occur because of three reasons:

(1) Forgetting or disregarding "common sense" safety rules

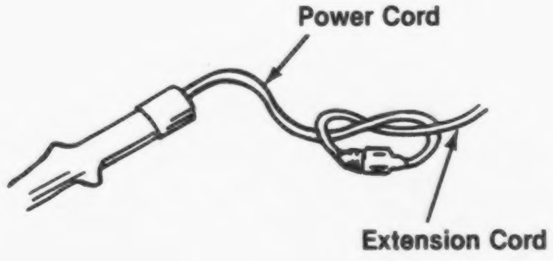
(2) Not knowing how to operate the equipment

(3) Improper use of equipment

- Always use properly grounded plugs and cords
- Use only the voltage supply recommended for a tool
- Do not use near flammable liquids
- Do not use in wet conditions
- Check cords and plugs for breaks in the insulation
- Use extension cords designed for outdoor use and tie to power cord

EXAMPLE:

FIGURE 35



- Never carry a power tool by the cord
- Use cords heavy enough to carry the full current

  **WARNING Never use an extension cord smaller than or rated lower than the power cord.**
- Do not expose cords to heat, oil, or sharp edges
- Avoid contact with a grounded conductor such as metal pipes, fences, or water
- Do not touch the starter while connecting an extension cord
- Unplug a tool when it is not in use
- Disconnect power before checking, adjusting, oiling, or cleaning
- Keep tool housing free of debris to prevent motor overheating

**OBJECTIVE 11** **State safety rules for specific pieces of equipment.**

- Rotary tiller

  a. Do not till near underground electric cables, pipes, or hoses

  b. Clear tines often

  NOTE: Debris or vegetation tangled on the tines can reach out and grab you or whip against your legs and ankles. Furthermore, machine efficiency is lowered by clogged tines.

  c. Do not operate on a steep slope

  NOTE: Steep slopes can cause the tiller to tip or turn over. A 15° slope will cause most four-cycle engines to stop oiling and to overheat.
- **Chipper/shredder**

  **WARNING The chipper/shredder is the most dangerous piece of equipment you will be working with. Use extreme caution and pay attention at all times.**

  a. Wear goggles or face shield

  NOTE: The high-speed hammers that tear up materials can throw chips out of the machine at a high rate of speed.

b. Use the proper tool to push material into the shredder. **Never push material into the machine with your hands.**

c. Stay away from the machine after the engine is shut off; the hammers keep rotating for 40-60 seconds or more.

- **Weed cutter**

a. Wear goggles or face shield

NOTE: Always wear long pants and a long-sleeve shirt to protect yourself from flying sand burrs, sticks, rock chips, and other debris.

b. Keep cutter away from your body; high-speed rotating string will cut through clothing and skin

- **Edger**

a. Wear goggles or face shield

b. Keep feet and hands away from cutting blade

c. Keep blade from hitting cement walks or curbing or other solid surfaces

NOTE: Blade hitting concrete or solid objects can bounce and throw the operator off balance. Solid objects dull or bend the blade and make the machine less efficient.

- **Lawnmower**

a. Clear lawn of debris; thrown objects travel at high speeds and can cause serious injury

b. Mow so that the discharge faces away from people and windows

c. Turn mower off when moving across non-grassy areas.

NOTE: A surprising number of accidents occur from thrown gravel and other solid objects when mowers are moved across a street or parking lot with the blade rotating.

- **Backpack mist blower**

  **NOTE:** The mist blower emits chemicals under medium-to-high pressure. There is danger of damaging plants and property from the pressure and of poisoning or illness from exposure to the chemicals.

  a. Do not spray on windy days

     **NOTE:** The fine mist is extremely prone to wind drift and will place chemicals on unwanted areas.

  b. Never spray toward other people

  c. Never walk into spray

  d. Know the chemicals you use and their hazards

**OBJECTIVE 12** **Match power tools with their uses.**

- **Weed cutter**—Used to cut herbaceous twigs, weeds and grass with a whirling nylon line; gas or electric

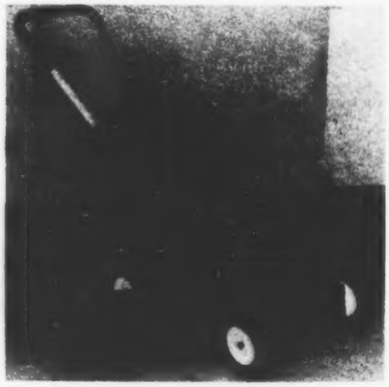
  **NOTE:** The string gradually wears away and is replaced manually, semi-manually or automatically.

  FIGURE 36

- **Rotary lawn mower**—Used to mow tall grass, tough seed stalks, and weeds and for turfs that don't require extremely high-quality mowing; a single spinning blade cuts to a desired height

  **NOTE:** Mowers can be gas or electric, pushed or self-propelled, 2 or 4 cycle engines. Reel-type mowers with a series of blades are used for high-quality mowing jobs.

  FIGURE 37

- **Rear-tine rotary tiller**—Used for medium and heavy cultivation 1" to 8" deep and to break untilled ground; usually has a powerful small engine; bulky and hard to use in small areas; gas powered

  FIGURE 38

- **Front-tine rotary tiller**—Used for light and medium cultivation 1" to 6" deep in vegetable and flower beds; will not break untilled ground, but is effective on previously tilled soil; does not work well in rocky or hard soils; chops mulch; gas powered

FIGURE 39

- **Hedge shears**—Used to shape and trim hedges; gas or electric

FIGURE 40

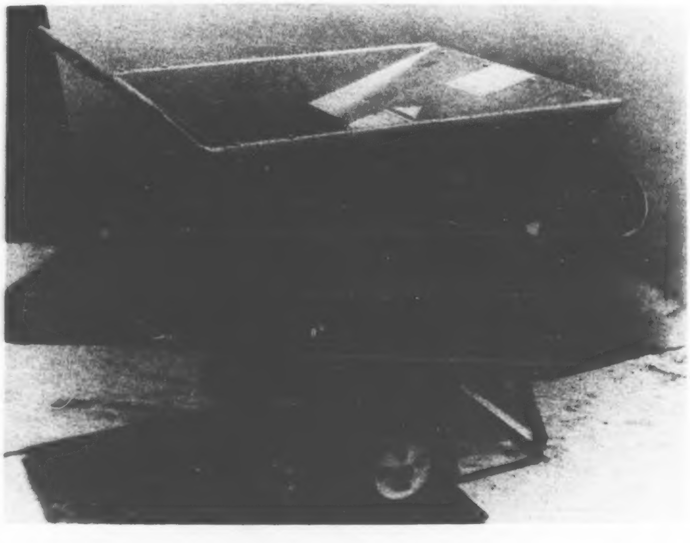
- **Edger**—Used to cut grass and weeds along curbs and sidewalks; electric or gas

FIGURE 41

- **Chipper/shredder**—Used to cut plant waste into small pieces; gas or electric

**NOTE:** Plant waste materials include grass, stems, stalks and twigs, branches or limbs. Available in a wide range of sizes; larger machines will cut larger branches. Chips can be easily disposed of or used as mulch.

FIGURE 42



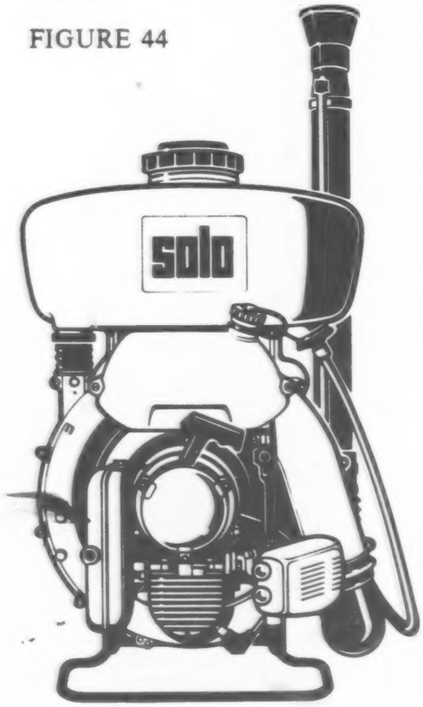
- **Cement mixer**—Used to make large quantities of soil or soilless media, or to mix plant nutrients; gas powered

FIGURE 43

- **Backpack mist blower**—Used to raise humidity in specific areas of a greenhouse; to apply foliate fertilizers or growth regulators; gas or electric

**NOTE:** Hose range and pressure depend on specific model. The spray can be powerful enough to damage plants, knock over pots and blow soil mix out of pots. Keep a safe distance between yourself and the plants when using the blower.

FIGURE 44



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## GAS VS. ELECTRIC PROS AND CONS

- **Gas powered tools**

  Advantages

  - Usually have more power and can handle rougher, heavier jobs
  - Can handle larger cutting parts and attachments

    EXAMPLE: Gas-powered hedge shears—can use 12-20" blade

  - Electric hedge shears—12-16" blade
  - Mobile, can be used anywhere

  Disadvantages

  - May need more maintenance than electric
  - Heavier to carry
  - Noisy—ear protection required
  - Produces fumes

- **Electric tools**

  Advantages

  - Lightweight
  - Quiet
  - Lower initial cost
  - No smoke or fumes

  Disadvantages

  - Lighter duty than gas models
  - Range restricted by length of cord
  - Can't be used in places without electricity, such as a golf course

## HOW TO TILL A GARDEN PLOT

### PREPARE THE SITE

Pick up all debris, sticks, posts, tools, etc.

Long weeds will clog the tines and can whip the operator. Cut weeds with a lawn mower before tilling. Or weeds can be cut with a cutter several weeks before tilling so they soften and will break rather than wrap around the tines.

Check moisture level:

Soil should flake and crack when squeezed. If it dents when squeezed, it is too wet to till. If it is tilled while wet, clods will form and dry rock-hard, ruining the soil until the next season.

If soil is too dry and hard, the tiller will only scrape the surface.

Have garden owner point out perennial plants that should not be tilled under; mark those areas and bypass them.

### PREPARE THE TILLER

Check all clutches and/or tension pulleys.

Check the fuel, oil, and guards, adjust as needed.

Check all exposed moving parts to insure they are firmly attached and in good operating condition.

Set the tines for only 2 inches for the first pass if you are tilling unbroken ground. If area has been tilled before, set tine no deeper than 3 inches.

### TILLING PATTERNS

**Push down on the handlebars to control the tiller.**

Use the right-size tiller for the job.

Operate at slow speeds to maintain control.

**Pattern 1**

1. Start at one end of the garden.
2. Make wide turns, leaving a row between the row just tilled and the next row.

   If you are using a rotary tiller in a small garden, you can use reverse gear to till every other row. Use caution.

3. Repeat turning tiller, picking up center row and tilling new rows until plot is finished.
4. Make the final pass at a right angle to the first passes to further break up clods and better mix the soil.
5. If needed, reset depth of tines to dig deeper and repeat the operation, this time starting in the same direction as the final pass.
6. With a rear-tine tiller, on the final pass, walk beside the tiller if you feel competent to do so. By walking alongside the tiller, freshly tilled soil will be free of footprints and compaction from footprints.

**Pattern 2**

1. Make the first pass the length of the garden, tilling all areas.
2. For the second pass, lower the tines and till at a right angle to the first pass (across the width of the garden).
3. Lower tines again and till the length for the third pass.
4. Lower tines, if needed, and till the width.
5. With a rear-tine tiller, on the final pass, walk beside the tiller if you feel competent to do so. By walking alongside the tiller, freshly tilled soil will be free of footprints and compaction from footprints.

## ASSIGNMENT SHEET 1

## HAND AND POWER TOOLS

## III

NAME ______________________________ SCORE _______

**OBJECTIVE 13**

**Explain hand-tool safety rules.**

**INTRODUCTION**

An accident with tools can cause physical pain and perhaps permanent damage and can mean lost time, energy and money. Safety is knowing how to use tools properly, staying alert and most of all, *paying attention*.

You will have to write these rules from memory on the test. Use this Assignment Sheet to help you learn them, think about them, and memorize them.

**DIRECTIONS**

Fill in the missing words to complete the safety rules for using hand tools. Use your common sense to figure out why these rules are made and why you must follow them. Make up examples to show that you understand the rule.

1. Always use a tool as it is ____________________ to be used.

   Why? ________________________________________

   ________________________________________

2. Stay ____________ any time you use hand tools or power tools.

   Why? ________________________________________

   ________________________________________

   ________________________________________

3. Keep tools in their ________________ ________________.

   Why? ________________________________________

   ________________________________________

   ________________________________________

4. Do not leave tools on the ________________________
or on the ground near work site.

Why? ____________________________________________

____________________________________________

____________________________________________

5. Lay tools down with ______________ facing into the ground.

Why? ____________________________________________

____________________________________________

____________________________________________

6. ____________________ tools before use and often during use.

Why? ____________________________________________

____________________________________________

____________________________________________

7. Keep cutting edges ________________________________

____________________________________________.

Why? ____________________________________________

____________________________________________

____________________________________________

8. Store sharp or pointed tools in ________________________

____________________________________________.

Why? ____________________________________________

____________________________________________

____________________________________________

9. Hold pruners and loppers __________________ while cutting.

Why? ____________________________________________

____________________________________________

____________________________________________

10. Locate all underground ______________________________ and

____________________ before digging.

Why? ______________________________________________

________________________________________________

________________________________________________

11. Wear ______________________________ clothing for the job.

Why? ______________________________________________

________________________________________________

________________________________________________.

Examples:

________________________________________________

________________________________________________

**ASSIGNMENT SHEET 2**

## HAND AND POWER TOOLS

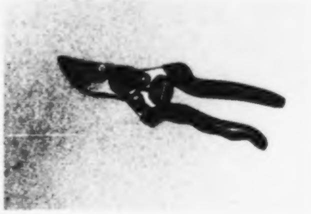
## III

NAME ______________________ SCORE ________

**OBJECTIVE 14** **Identify hand tools.**

**INTRODUCTION** There is an old saying, "A worker is only as good as his tools." Of course, the saying is not entirely true, because not only must you use good quality tools, you must also know how to use them correctly and effectively.

**DIRECTIONS** Write the name of the tool in the blank.



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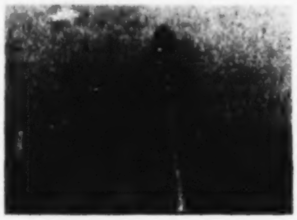

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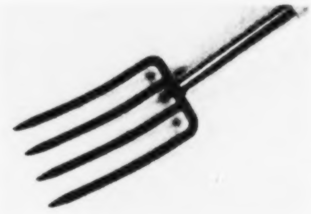

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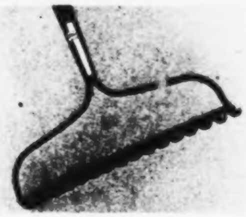

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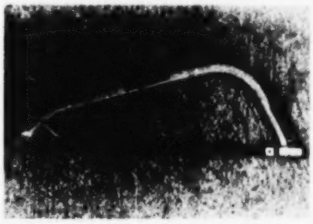

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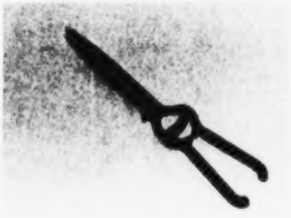

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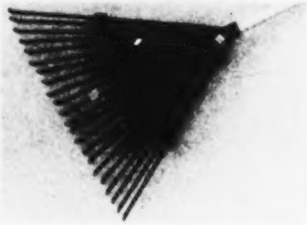

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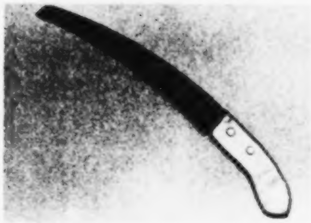

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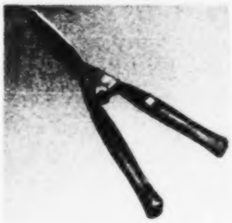

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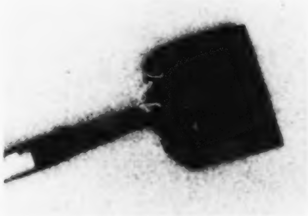

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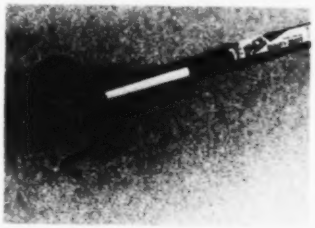

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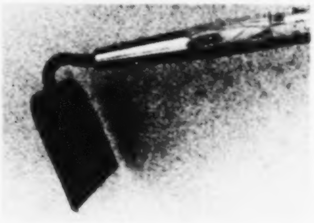

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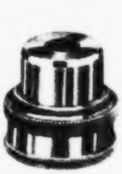

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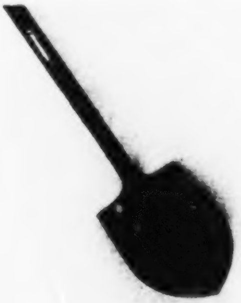


14. ______________________

15. ______________

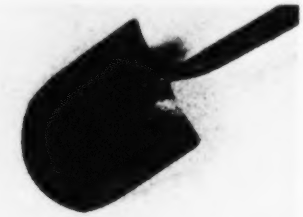
16. ______________

17. ______________

18. ______________

19. ______________________________

20. ______________



21. ______________

22. ____________________

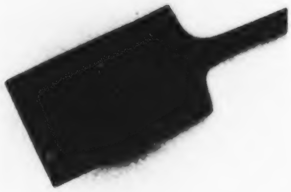
23. ____________________

24. ____________________

25. ____________________

26. ____________________

27. ____________________



28.____________________

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**ASSIGNMENT SHEET 3**

## HAND AND POWER TOOLS

# III

NAME ______________________________ SCORE ________

**OBJECTIVE 15**

**Explain fuel safety rules.**

**INTRODUCTION**

Gasoline and diesel engines have made our lives much easier and our work faster, lighter, and more efficient. The fuels that power these tools are only as safe as the operator who uses them.

Gasoline fumes can ignite from a single spark. A person breathing fumes can become lightheaded or dizzy and coordination and balance can be temporarily affected. To breathe fumes and then operate equipment places the operator, the equipment, the project, and surrounding property in danger.

Learn the safety rules for using fuel. You will have to write these rules from memory on the test. Use this Assignment Sheet to help you learn them, think about them, and memorize them.

**DIRECTIONS**

Fill in the missing words to complete the safety rules for using power tools. Use your common sense to figure out why these rules are made and why you must follow them. Make up examples to show that you understand the rule.

### FUEL SAFETY

1. Mix and pour fuels ______________________________ .

   Why? ______________________________

   ______________________________

   ______________________________

2. Use only fuel or fuel mixture ____________________ for each tool.

   Why? ______________________________

   ______________________________

   ______________________________

3. Never____________________while mixing and pouring fuels.

   Why? ____________________________________________

   __________________________________________________

   __________________________________________________

4. Use only________________________fuel containers.

   Why? ____________________________________________

   __________________________________________________

   __________________________________________________

5. Never store fuel indoors where_____________________can be ignited by a flame or spark.

   Why? ____________________________________________

   __________________________________________________

   __________________________________________________

6. Wipe up all spills on________________and______________.

   Why? ____________________________________________

   __________________________________________________

   __________________________________________________

7. Move away from a______________ ______________, wipe off excess fuel and allow fuel to evaporate from equipment before__________________the__________________.

   Why? ____________________________________________

   __________________________________________________

   __________________________________________________

8. Never remove the gas cap or add fuel when the engine is ________________________or________________________ .

   Why? ____________________________________________

   __________________________________________________

   __________________________________________________

9. Always allow the engine to cool before ________________

or ______________________ a tool.

Why? ________________________________________

________________________________________

________________________________________

10. Empty the ___________ ___________ before storing a tool.

Why? ________________________________________

________________________________________

________________________________________

11. Operate equipment only in a ___________-_____________ area.

Why? ________________________________________

________________________________________

________________________________________

**ASSIGNMENT SHEET 4**

# HAND AND POWER TOOLS

# III

NAME ______________________________ SCORE ________

**OBJECTIVE 16**

**Explain power tool safety rules.**

**INTRODUCTION**

Power tools can cause very serious accidents. A foot, a hand, an eye can be gone before you realize what's happening. You must pay attention and concentrate on operating the tools any time you use them.

You've heard the saying, "Carelessness causes accidents." Whether you are pouring gasoline and smoking, standing in water and using an electric tool, or wearing loose clothing or jewelry around moving machine parts, a second's carelessness can mean a lifetime of disability.

Although they are not covered in this Assignment Sheet, maintenance and storage are closely related to tool safety. Clean tools that operate smoothly and have sharp cutting edges are easier to use correctly and less likely to cause accidents or time lost from the job.

Learn these power tool safety rules. You will have to write these rules from memory on the test. Use this Assignment Sheet to help you learn them, think about them, and memorize them.

**DIRECTIONS**

Fill in the missing words to complete the safety rules for using power tools. Use your common sense to figure out why these rules are made and why you must follow them. Make up examples to show that you understand the rule.

1. Read, understand, and follow the warnings and instructions in

   the______________ ______________before using any tool;

   know all______________________and how to operate them.

   Why? ________________________________________________

   ________________________________________________

   ________________________________________________

2. Review manuals at the beginning of each ______________.

   Why? ________________________________________

   ________________________________________

   ________________________________________

3. Check machine and make all adjustments__________turning on the engine.

   Why? ________________________________________

   ________________________________________

   ________________________________________

4. Check_______________ _______________and keep them in place during operation.

   Why? ________________________________________

   ________________________________________

   ________________________________________

5. Never operate power equipment when you are tired,

   ______________, or under the influence of alcohol,

   ____________________ or ____________________

   Why? ________________________________________

   ________________________________________

   ________________________________________

6. Make sure there are no people or animals in the operating area

   or where materials or objects might be_______________.

   Why? ________________________________________

   ________________________________________

   ________________________________________

7. Remove all ________________ from the area before operating.

Why? ________________________________________________

________________________________________________

________________________________________________

8. Do not leave a ________________________ machine unattended.

Why? ________________________________________________

________________________________________________

________________________________________________

9. Know how to ____________ and ____________ machine before operating.

Why? ________________________________________________

________________________________________________

________________________________________________

10. Turn off equipment immediately when it ________________ .

Why? ________________________________________________

________________________________________________

________________________________________________

11. ____________ engine and disconnet, ___________ ___________ before cleaning, fueling or making adjustments.

Why? ________________________________________________

________________________________________________

________________________________________________

12. Keep hands, feet and clothing away from __________________ ____________ .

Why? ________________________________________________

________________________________________________

________________________________________________

13. Always wear heavy, long_______________and_______________.

Why? _______________________________________________

_______________________________________________

_______________________________________________

14. Wear_______________, safety_________________ and

_____________protection when needed.

Why? _______________________________________________

_______________________________________________

_______________________________________________

15. Do not wear gloves when hands are near_________________.

_______________________________________________.

Why? _______________________________________________

_______________________________________________

_______________________________________________

16. Remove______________________and tie___________________

_____________ back.

Why? _______________________________________________

_______________________________________________

_______________________________________________

17. Wear ___________________ - ___________________ clothing.

Why? _______________________________________________

_______________________________________________

**ASSIGNMENT SHEET 5**

## HAND AND POWER TOOLS

III

NAME ______________________ SCORE ______

**OBJECTIVE 17**

**Explain safety rules for operating electric power tools.**

**INTRODUCTION**

Electric tools, because they are lighter, have fewer moving parts, and are more quiet than gas-powered tools, seem to be safer. This very feeling of being safer can cause us to pay less attention, to be more careless in checking equipment and in operating it.

A break in insulation, a split second in a water puddle, a momentary lapse in concentration with a finger on the starter switch can cause an accident that can lay you off work for a day or for several months.

Learn these power tool safety rules. You will have to write these rules from memory on the test. Use this Assignment Sheet to help you learn them, think about them, and memorize them.

**DIRECTIONS**

Fill in the missing words to complete the safety rules for using electric tools. Use your common sense to figure out why these rules are made and why you must follow them. Make up examples to show that you understand the rule.

1. Always use properly ______________ plugs and cords.

   Why? ______________________________

   ______________________________

   ______________________________

2. Use only the ______________ ______________ recommended for a tool.

   Why? ______________________________

   ______________________________

   ______________________________

3. Do not use near____________________ ____________________ .

Why? ________________________________________

____________________________________________

____________________________________________

4. Do not use in______________conditions.

Why? ________________________________________

____________________________________________

____________________________________________

5. Check cords and plugs for breaks in the ____________________.

Why? ________________________________________

____________________________________________

____________________________________________

6. Use extension cords designed for ____________________

use and________________to power cord.

Why? ________________________________________

____________________________________________

____________________________________________

7. Never carry a power tool by the ____________________.

Why? ________________________________________

____________________________________________

____________________________________________

8. Use cords heavy enough to carry the ____________________.

____________________________________________

Why? ________________________________________

____________________________________________

____________________________________________

9. Do not expose cords to__________, __________, or

__________________ .

Why? ____________________

____________________

____________________

10. Avoid contact with a grounded conductor such as__________, __________or__________ .

Why? ____________________

____________________

____________________

11. Do not touch the__________while connecting an extension cord.

Why? ____________________

____________________

____________________

12. __________a tool when it is not in use.

Why? ____________________

____________________

____________________

13. Disconnect power before__________, __________,

__________, or__________ .

Why? ____________________

____________________

____________________

14. Keep tool housing free of debris to prevent________________

______________________________________________________.

Why? ____________________________________________

______________________________________________________

______________________________________________________

**ASSIGNMENT SHEET 6**

## HAND AND POWER TOOLS

## III

NAME ______________________________ SCORE ______

**OBJECTIVE 18** **Explain safety rules for specific pieces of equipment.**

**INTRODUCTION**

Each tool performs jobs that used to be done by hand with clippers, shovels, hoes, plows, and hand sprayers. With power comes the opportunity for accidents and injury.

When you know the specific dangers commonly associated with the equipment you will be using, and how to avoid those dangers, you will be more confident and more competent on the job. You will be safe to work with, less likely to endanger yourself or others.

Learn these safety rules. You will have to write these rules from memory on the test. Use this Assignment Sheet to help you learn them, think about them, and memorize them.

**DIRECTIONS**

Fill in the missing words to complete the safety rules for using specific pieces of equipment. Use your common sense to figure out why these rules are made and why they must be kept. Make up examples to show that you understand the rule.

1. **Rotary tiller**

   a. Do not till near ______________________ electric cables, pipes or hoses.

   Why? ________________________________________

   ________________________________________

   ________________________________________

   b. Clear ______________ often.

   Why? ________________________________________

   ________________________________________

   ________________________________________

c. Do not operate on a_______________ _______________.

Why? ________________________________________

________________________________________

________________________________________

2. **Chipper/shredder**

a. Wear_____________________ _____________________or

_________________ _________________.

Why? ________________________________________

________________________________________

________________________________________

b. Use the proper tool to_______________material into the shredder.

Never force material into the machine with your

____________.

Why? ________________________________________

________________________________________

________________________________________

c. Stay away from the machine after the engine is shut off;

the hammers keep rotating for__________________ - __________________seconds or more.

Why? ________________________________________

________________________________________

________________________________________

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3. **Weed cutter**

a. Wear______________or_____________ ______________.

Why?____________________________________________

________________________________________________

________________________________________________

b. Keep cutter away from your____________.

Why?____________________________________________

________________________________________________

________________________________________________

4. **Edger**

a. Wear_____________________ __________________or

_________________ ________________.

Why?

________________________________________________

________________________________________________

b. Keep______________and_____________away from cutting blade.

Why?____________________________________________

________________________________________________

________________________________________________

c. Keep_____________from hitting cement walks or curbing or other solid surfaces.

Why?____________________________________________

________________________________________________

________________________________________________

5. **Lawnmower**

   a. Clear lawn of________________________ .

   Why? ________________________________________

   ________________________________________

   ________________________________________

   b. Mow so that the discharge faces away from

   ______________and ________________ .

   Why? ________________________________________

   ________________________________________

   ________________________________________

   c. Turn mower off when moving across________________ areas.

   Why? ________________________________________

   ________________________________________

   ________________________________________

6. **Backpack mist blower**

   a. Do not spray on________________ ______________ .

   Why? ________________________________________

   ________________________________________

   ________________________________________

   b. Never spray toward______________ ______________ .

   Why? ________________________________________

   ________________________________________

   ________________________________________

c. Never__________into spray.

Why?________________________________________

________________________________________

________________________________________

d. Know the chemicals you use and their______________.

Why?________________________________________

________________________________________

________________________________________

7. List the power tools that require safety glasses or face shields.

________________________________________

________________________________________

8. List the power tools that can cause injury to your feet, ankles and legs.

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**ASSIGNMENT SHEET 7**

# HAND AND POWER TOOLS

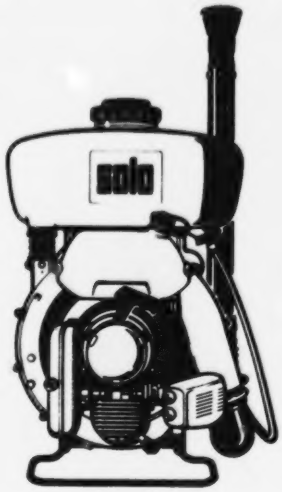
# III

NAME ______________________________ SCORE ________

**OBJECTIVE 19** **Identify power tools.**

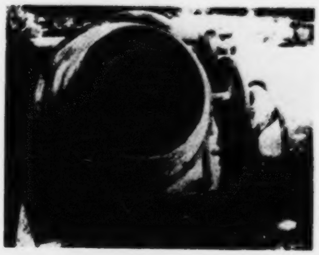
**INTRODUCTION** Most of the power tools in this unit are the basic tools that you will be expected to know how to operate and use effectively. There are many more power tools that are used for jobs in turf operations, fruit and nut production, and nursery operations.

**DIRECTIONS** Write the name of the tool in the blank.



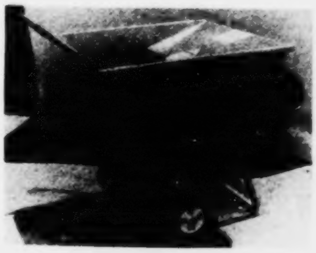
1. ____________________

2. ____________________



3. ______________________

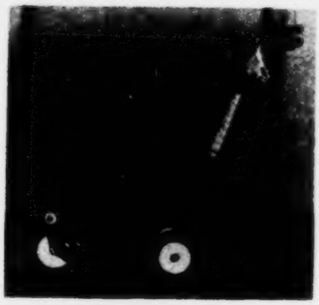
4. ______________________



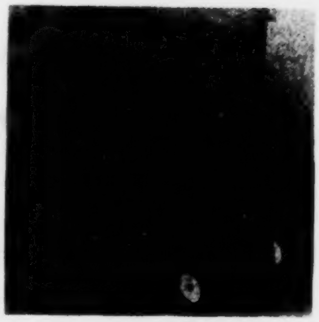
5. ______________________

6. ______________________

7. ______________________



8. ______________________



9.________________________

**ASSIGNMENT ANSWERS**

# HAND AND POWER TOOLS

# III

**ASSIGNMENT SHEET 1**

NOTE: Check that answers to the "why" sections show reasonable thought and are pertinent to the rule and that examples represent the rule.

1. Designed

   Improper use of tools is a major cause of accidents

2. Alert

   Lack of paying attention can cause accidents and injury

3. Proper places

   So tools can be easily found; will not be in way of traffic or cause accidental injury

4. Floor

   Someone can trip on them; tools, especially those with cutting edges or tines, can cause injury if stepped on

5. Tines

   So tines won't stab someone in the foot or so tool handle won't come up and hit someone in the face

6. Inspect

   To be sure tool is properly maintained and in working order

7. Sharp

   Dull tools take more pressure to use and can slip, causing injury

8. A place where you will not stab yourself with them

   To avoid getting stabbed or cut

9. Straight

   Twisting will damage tools and plants

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10. Utility lines and pipes

    Cutting a power line or telephone line could cause electric shock; a broken pipe can cause damaged property and require expensive repairs

11. Appropriate

    To protect the body from injury and from flying objects

    Examples: Safety goggles or face shield; boots; close-fitting clothing; ear protection; long-sleeved shirt; heavy, long pants; respirators where needed.

**ASSIGNMENT SHEET 2**

1. Hand pruner
2. Lopping shears
3. Garden fork
4. Garden rake
5. Bow saw
6. Grass clippers
7. Leaf rake
8. Pruning saw
9. Hedge shears
10. Edger
11. 4-tine cultivator or potato fork
12. Garden hoe
13. Water breakers
14. Pointed shovel
15. 3-prong cultivator
16. Bulb planter
17. Root feeder
18. Hose-end sprayer

19. Compressed-air sprayers

20. Scoop shovel

21. Round-nose shovel

22. Knife

23. Dibble

24. Pole pruner

25. Post-hole digger

26. Square-nose shovel

27. Wands

28. Spade

**ASSIGNMENT SHEET 3**

NOTE: Check that answers to the "why" sections show reasonable thought and are pertinent to the rule and that examples represent the rule.

1. Outdoors

   So fumes won't build up to cause fires from electrical connections or pilot lights, to prevent dizziness or other personal injury

2. Recommended

   Wrong fuel or wrong fuel mix can affect performance; may damage machine

3. Smoke

   Fumes could ignite from lit cigarette or matches

4. Approved

   To avoid spills: glass containers can break, gasoline will melt some plastics

5. Fumes

   Fumes can explode, even when you think they are not concentrated enough to cause problems

6. Machinery and drives

   Sparks from engine or drives can ignite gas

7. Spill area, starting engine

   To prevent light-headedness from inhaling fumes or possible explosion

8. Running or hot

   To avoid danger of fire

9. Transporting or storing

   Danger of burns

10. Fuel tank

    To prevent possible explosion, fire, or gas evaporation

11. Well-ventilated

    Fumes can be poisonous, cause dizziness, unconsciousness, coma, brain damage, or possible death

**ASSIGNMENT SHEET 4**

NOTE: Check that answers to the "why" sections show reasonable thought and are pertinent to the rule and that examples represent the rule.

1. Operating manual, controls

   So equipment can be used safely, properly, and efficiently; to avoid accidents due to misuse of tool

2. Season

   After months of not using the equipment, the operator needs to be reminded about the operating procedures and safety precautions

3. Before

   Machine will be safe to operate and there will be no danger of trying to make adjustments while machine is in operation; saves time during operation

4. Safety shields

   To insure that they are operating properly and can prevent accidents

5. Ill, drugs, medication

   Illness and drugs may make the operator drowsy, can affect judgment, reaction time, and coordination

6. Thrown

   Thrown objects can injure the operator, other people, animals, and property

7. Debris

   To prevent accidental injury

8. Running

   Machine could run out of control, causing injury and damage; a child or other person could attempt to use the machine and be in danger

9. Stop, start

   If operator is unfamiliar with the machine and it does not run properly or the operator can't control the machine, or loses confidence, she or he can stop the machine immediately, before injury or increased loss of control occur

10. Overheats

    To prevent danger of fire

11. Stop, spark plug

    To reduce the possibility of accident or injury from moving parts while working on the machine; to prevent accidental start-up

12. Moving parts

    To prevent cuts or becoming tangled in the equipment

13. Pants, boots

    To protect feet, ankles and legs from thrown objects

14. Gloves, glasses, ear

    Gloves protect hands from blisters; glasses protect eyes from dust and flying objects; hearing protection prevents loss of hearing

15. Moving parts

    Gloves can becoming tangled in moving parts and hands could be injured

16. Jewelry, long hair

    To prevent these parts from become tangled in moving parts and either pulling the part or body into the moving parts or tearing off a finger, earlobe, or section of scalp

17. Close-fitting

    To prevent clothing from being caught and tangled in moving parts

**ASSIGNMENT SHEET 5**

NOTE: Check that answers to the "why" sections show reasonable thought and are pertinent to the rule and that examples represent the rule.

1. Grounded

   To prevent a short or a shock

2. Voltage supply

   Too much voltage can cause wires to overheat; too little voltage can cause machine to run slowly and ineffectively

3. Flammable liquids

   To avoid possibility of explosion

4. Wet

   Water is a conductor of electricity; danger of shock or electrocution; danger of short

5. Insulation

   Breaks in insulation can cause a short, a spark, or shock

6. Outdoor, tie

   Outdoor cords are made to resist dampness and water and with thick outer coatings to resist cracking and knicks; cords are tied to prevent accidental unplugging

7. Cord

   Weight can break the cord, loosen wires or insulation

8. Full current

   Wires that are too small can overheat and create a danger of fire

9. Heat, oil, or sharp edges

   Protect cord from melting, from deteriorating or becoming too slick to handle, from cuts and nicks

10. Metal pipes, fences or water

    To avoid shock and electrocution

11. Starter

    Machine could accidentally start and run out of control

12. Unplug

    To avoid accidental fires

13. Checking, adjusting, oiling, or cleaning

    To avoid accidental start-up and injury

14. Motor overheating

    To avoid fire and damaging equipment

**ASSIGNMENT SHEET 6**

NOTE: Check that answers to the "why" sections show reasonable thought and are pertinent to the rule and that examples represent the rule.

1. a. Underground

   Danger of shock, electrocution, expensive damage to property

   b. Tines

   Debris or vegetation tangled on the tines can reach out and grab you or whip against your legs and ankles. Furthermore, machine efficiency is lowered by clogged tines.

   c. Steep slope

   Steep slopes can cause the tiller to tip or turn over. A 15° slope will cause most four-cycle engines to stop oiling and to overheat.

2. a. Safety glasses or face shield

   To protect eyes and face from flying and thrown objects

   b. Push, hands

   Spinning hammers can cause injury

   c. 40-60

   To prevent injury to hands and face

3. a. Safety glasses or face shield

   To protect eyes and face from flying and thrown objects

   b. Body

   High-speed rotating string will cut through clothing and skin

4. a. Safety glasses or face shield

   To protect eyes and face from flying and thrown objects

   b. Hands, feet

   To avoid injury such as loss of toes or fingers

c. Blade

Blade hitting concrete or solid objects can bounce and throw the operator off balance. Solid objects dull or bend the blade and make the machine less efficient.

5. a. Debris

   Thrown objects travel at high speeds and can cause serious injury

   b. People, windows

   To prevent injury to people and property

   c. Non-grassy

   Thrown gravel and other solid objects can cause injury or damage when mowers are moved across a street or parking lot with the blade rotating

6. a. Windy days

   Drift can place chemicals on unwanted areas

   b. Other people

   Danger of exposure to chemicals

   c. Walk

   Danger of exposing oneself to chemicals

   d. Hazards

   To know how to protect oneself; to be prepared for accidental exposure

7. Chipper/shredder, weed cutter, edger

8. Tiller, weed cutter, edger, lawn mower

**ASSIGNMENT SHEET 7**

1. Mist blower
2. Weed cutter
3. Cement mixer
4. Front-tine rotary tiller
5. Chipper/shredder
6. Rear-tine rotary tiller
7. Hedgers
8. Edger
9. Rotary lawn mower

## HAND AND POWER TOOLS

**OBJECTIVE 20a**

**Trim with an edger.**

**TOOLS AND MATERIALS**

- Edger—gas or electric
- Operating manual
- Extension cord if using electric edger
- Suitable area for edging such as a sidewalk
- Safety eye and ear protection
- Protective clothing
- Rake
- Broom
- Dustpan or scoop shovel
- Large plastic bags

**PROCEDURE**

1. Read manual for safety and operating procedures.
2. Carry or move edger to the selected location.

   **CAUTION: Do not carry electrical equipment by the cord.**

3. Check edger before operating:
   a. Gas-powered model
      (1) Check oil level. Adjust if needed, following manufacturer's recommendations
      (2) Check fuel level. Fill as needed. Use a funnel to avoid spilling fuel. Never fill a hot engine.

      **NOTE:** Use proper type of fuel or proper gas/oil mix if required.

**CAUTION: Avoid spilling gasoline. Fumes create a health and fire hazard and gas liquid kills plants. If fuel is spilled, move yourself and the equipment out of the area, wipe all fuel off the machine, and wait until machine is completely dry before starting it.**

        (3) Check that guard is in place and working properly.

    b. Electric model

        (1) Check power cord, extension cord, and electrical connectors.

        (2) Repair or replace as needed.

        (3) Check that guard is in place and working properly.

4. Check the depth adjustment of the cutter; reset as needed.

5. Clear the work area of rocks, sticks, and other debris.

6. Make sure area is clear of people and animals.

7. Put on safety glasses and ear protection.

8. Start the edger.

    a. Gas-powered model

        (1) Connect spark plug wire, if disconnected

        (2) Pull out the choke.

        (3) Grasp starter handles and pull the rope quickly.

        (4) Return rope slowly.

        (5) Repeat until the motor starts.

    b. Electric model

        (1) Make sure all switches are in OFF position.

        (2) Tie and connect power cord and extension cord.

        (3) Connect extension cord to power source.

        (4) Turn power switch to ON position

        (5) Press starter switch.

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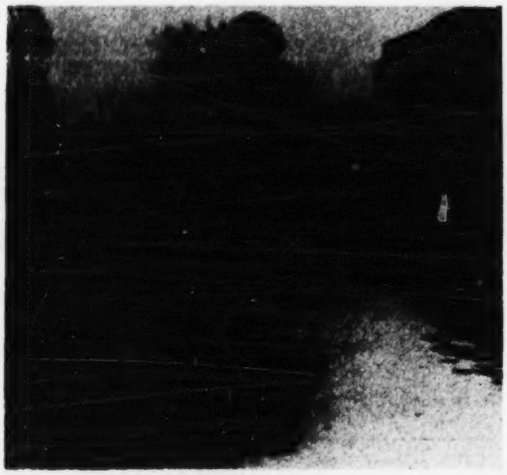
9. Place wheels on the paved surfaces.

10. Engage blade and allow it to spin freely before moving into turf.

11. Operate the edger so that the protective guard guide is positioned between the walk and the rotary blade.

FIGURE 1



12. Do not allow the rotating blade to contact the concrete walk or drive.

13. Keep a firm hold on the handle and walk slowly, moving tool along edge of paved surface.

FIGURE 2

14. If the tool slows, back it up an inch or two until the blade comes up to normal speed.

15. Turn switch to OFF position, stopping motor, when job is completed.

16. Have your instructor check your work.

17. Disconnect equipment:

    a. Gas-powered model—Disconnect spark plug wire

    b. Electric model—Unplug edger and neatly coil extension cord

18. Allow equipment to cool as you clean the work area.

    a. Sweep sidewalk area and rake lawn area

    b. Use scoop shovel to load grass cuttings into plastic bags.

    c. Close plastic bags and remove them.

19. Clean all tools and equipment.

20. Return tools and materials to proper storage area.

**OBJECTIVE 20b** **Operate a front-tine rotary tiller.**

**TOOLS AND MATERIALS**

- Front-tine rototiller
- Operating manual
- Suitable area for tilling
- Safety glasses
- Protective clothing: heavy, long pants, boots, or hard-soled shoes

  NOTE: Long weeds will clog the tines and can whip the operator. Cut weeds with a lawn mower before tilling.

Check moisture level: Soil should flake and crack when squeezed. If it dents when squeezed, it is too wet to till.

**PROCEDURE**

1. Read manual for safety and operating procedures.

   NOTE: If you have not operated this machine before, study the manual and go to an open area. Review this job sheet. Practice starting, engaging and stopping the machine. A tiller can get out of control when you are not familiar with it.

2. Move tiller to the location selected by your instructor.
3. Check engine oil level. Adjust according to manufacturer's recommendations, if needed.
4. Check fuel level. Fill as needed:
   a. Use proper type of fuel or proper gas/oil mix if required.
   b. Make sure engine is cool.

   **WARNING** **Never fill a hot engine.**

   c. Use a funnel to avoid spilling fuel.

**CAUTION: Avoid spilling gasoline. Fumes create a health and fire hazard and gas liquid kills plants. If fuel is spilled, move yourself and the equipment out of the area, wipe all fuel off the machine, and wait until machine is completely dry before starting it.**

5. Check that guard is in place and working properly.

6. Clear work site of stones, sticks, and other objects.

   NOTE: If the garden has been worked previously, search for and remove stakes and heavy stalks and stringy weeds that could tangle in the tines.

7. Place tiller at one end of the section.

8. Make sure the tine control lever is disengaged.

   NOTE: On some models, the tine control lever is on the handle. Pulling the lever to the handle engages the tines. The lever is spring loaded, and when released, disengages the tines. Make sure the lever works correctly before you operate the machine.

9. Adjust the depth control. Set to shallow tilling for the first pass, then reset for successive passes.

   NOTE: The depth control lever is a slotted bar on the back of the tiller. The lower it is set, the deeper the tiller digs.

10. Pull out the choke.

11. Grasp the starter handle and pull rope out quickly.

12. Return rope slowly.

13. Repeat until engine starts.

14. Push choke in slowly.

15. Stand behind tiller and increase throttle to appropriate speed.

16. Engage tine control lever to begin tilling.

17. Let the tiller pull itself forward.

    NOTE: You do not have to push or force the tiller, you only have to guide it. Let the machine do the work.

18. Control speed by moving handles up or down:
    a. To move tiller forward—Gently lift up on handles.
    b. To hold tiller in place—Push down slightly.
19. Turn the tiller 180°
    a. Release lever to disengage the tines.
    b. Turn machine, walking behind it.
    c. Pull lever to handlebar and engage tines.
20. Repeat operating and turning tiller until your instructor indicates you should stop.
21. Stop the engine when job is complete:
    a. Release the tine control lever to disengage tines.
    b. Slow engine speed.
    c. Turn switch to OFF.
    d. Move depth control bar to travel position (all the way up).
22. Have your instructor check your work.
23. Allow tiller to cool.
24. Disconnect spark plug.
25. Clean dirt and debris from tines and tiller.
26. Put away tools and materials and clean the work area.

## JOB SHEET 3 — HAND AND POWER TOOLS — III

**OBJECTIVE 20c**

**Operate a rear-tine rotary tiller.**

**TOOLS AND MATERIALS**

- Rear-tine rotary tiller
- Operating manual
- Suitable area for tilling
- Safety glasses
- Protective clothing: heavy, long pants, boots, or hard-soled shoes

  **NOTE:** Long weeds will clog the tines and can whip the operator. Cut weeds with a lawn mower before tilling.

Check moisture level: Soil should flake and crack when squeezed. If it dents when squeezed, it is too wet to till.

**PROCEDURE**

1. Read manual for safety and operating procedures. Locate all controls.

   **NOTE:** If you have not operated this machine before, study the manual and go to an open area. Review this job sheet. Practice starting, engaging and stopping the machine. A tiller can get out of control when you are not familiar with it. Particularly practice turning and stopping the machine quickly.

2. Move tiller to the location selected by your instructor.
3. Check engine oil level. Adjust according to manufacturer's recommendations, if needed.
4. Check fuel level. Fill as needed:
   a. Use proper type of fuel or proper gas/oil mix if required.
   b. Make sure engine is cool.

   **WARNING** **Never fill a hot engine.**

   c. Use a funnel to avoid spilling fuel.

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**CAUTION: Avoid spilling gasoline. Fumes create a health and fire hazard and gas liquid kills plants. If fuel is spilled, move yourself and the equipment out of the area, wipe all fuel off the machine, and wait until machine is completely dry before starting it.**

5. Check that guard is in place and working properly.

6. Clear work site of stones, sticks, and other objects.

   NOTE: If the garden has been worked previously, search for and remove stakes and heavy stalks and stringy weeds that could tangle in the tines.

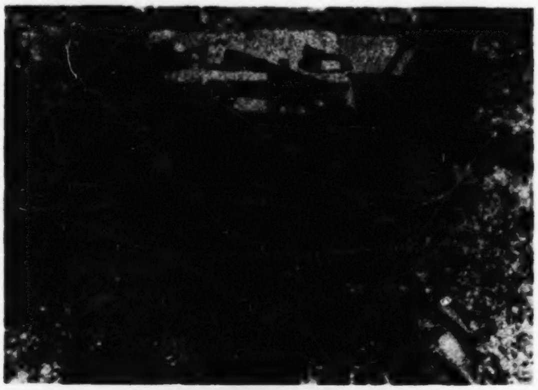
7. Place tiller at one end of the section.

8. Place the tine control lever (PTO clutch lever) in NEUTRAL or DISENGAGE position

FIGURE 1

9. Place the wheel control lever in NEUTRAL position.

FIGURE 2



10. Adjust the tine depth control to the appropriate depth.

**NOTE:** It is better to make progressively deeper cuts with each pass than to attempt a single deep pass.

FIGURE 3

11. Pull out the choke.

12. Start engine:

    a. Grasp the starter handle and pull out the rope rapidly.

    b. Return rope slowly.

    c. Repeat until engine starts.

13. Slowly push the choke in.

14. Stand behind the machine and engage the tine control lever (PTO clutch lever).

15. Increase throttle to appropriate speed.

16. Place the speed selector in the SLOW position.

17. Place the wheel control lever in the FORWARD position.

18. Guide the tiller using the handle bars.

    NOTE: Some manufacturers recommend standing to one side and guiding with one hand to avoid walking on tilled soil. Practice guiding the machine with *both hands* and making several turns until you attempt to steer with one hand only.

    FIGURE 4

19. Let the tiller move itself forward. Do not try to push or force the machine.

    **WARNING** **Keep feet away from rotating tines.**

    NOTE: If the tiller begins to jump, raise the handlebars.

20. Turn the tiller:
    a. Slow the engine.
    b. Lift tines from the soil by raising handlebars.
    c. Place the wheel control lever in NEUTRAL position.
    d. Place the tine control lever in NEUTRAL or DISENGAGE position.
    e. Place the wheel control lever in FORWARD position.
    f. Swing the tiller around 180 until you are facing the same direction as the starting point.
    g. Place the wheel control lever in NEUTRAL position.
    h. Place tine control lever in ENGAGE position.
    i. Return the wheel control lever to FORWARD position and resume tilling.

    NOTE: In tight areas the wheel control lever can be placed in REVERSE position and then the tiller can be turned. Use extreme care. Always disengage tines before using reverse. Only experienced operators should attempt tilling in tight areas.

21. Operate on a straight stretch and turn again.

22. Repeat operating and turning tiller until your instructor indicates you should stop.

23. Stop the engine:
    a. Slow engine speed.
    b. Lift tines from soil using handlebars.
    c. Place wheel control lever in NEUTRAL position.
    d. Place tine control lever in NEUTRAL or DISENGAGE position.
    e. Turn engine switch to OFF position.

24. Adjust tines: if repeating passes, adjust tine position to dig deeper. If finished tilling, raise tines to travel position (all the way up).

**NOTE:** On final pass, walk beside tiller if you feel competent to do so. By walking alongside the tiller, freshly tilled soil will be free of footprints and compaction from footprints.

25. Have instructor check your work.

26. Allow tiller to cool.

27. Disconnect spark plug wire.

28. Clean tiller, remove dirt and debris.

29. Put away tools and materials and clean the work area.

**OBJECTIVE 20d** **Mix medium with a cement mixer.**

**TOOLS AND MATERIALS**

- Media materials required for the mix

  NOTE: Get list of ingredients and proportions from your instructor.

- Operating manual
- Clean mixing bowl or bucket if small amounts of nutrients are used
- Concrete mixer
- Mixer operating manual
- Wheelbarrow
- Shovel or garden hoe
- Water hose
- Measuring containers for amount and proportions of media materials
- Wetting agent, if dry peat moss is used
- Granular or slow-release fertilizer

  NOTE: If media is not for immediate use, do not add fertilizers at this time. If left to stand, fertilizer will work through the medium to the bottom of the storage container.

- Storage containers

**PROCEDURE**

1. Read operating manual for instructions and safety precautions.

   NOTE: Know the holding capacity of the mixer and do not exceed it, or materials will not mix properly.

2. Locate controls, particularly OFF or KILL SWITCH.
3. Gather materials to the mixing area.

4. If using small amounts of fertilizers or nutrients, thoroughly mix these first in a bowl or bucket to give them enough mass to blend into mixture.

   EXAMPLES: Dolomite limestone, superphosphate, potassium nitrate, fritted trace elements, calcium carbonate lime, etc.

5. If using dry peat moss, prepare it for mixing:

   NOTE: Peat clumps must be broken up before mixing to provide a uniform media. If not thoroughly wetted first, it will absorb moisture from the rest of the mixture.

   a. Spread a thin layer of peat on floor or mixing table.

   b. Mix and apply wetting agent according to directions.

      NOTE: If peat is unusually dry, a second application of wetting agent may be needed.

   c. Water thoroughly.

   d. Break up lumps.

6. Place specified amounts of materials in mixer.

7. Add enough water to prevent dust and mix moisture through the mix with shovel or hoe.

8. Turn on mixer until well blended.

9. Place wheelbarrow in front of mixer.

10. Test moisture level, if desired:

    a. Turn off mixer.

    b. ALLOW MIXER TO COME TO A COMPLETE STOP.

    c. Squeeze a handful of medium; if moisture level is correct, it will form into a solid mass.

    d. Add water, if needed, and turn mixer on.

11. Dump mixture into wheelbarrow, according to manufacturer's instructions.

**WARNING Do not attempt to grab handwheel to stop an accidental discharge. Serious injury could result.**

12. Have your instructor check your work.
13. Shovel mixture into storage containers.
14. Store properly.
15. Put away tools and materials and clean the work area.

**JOB SHEET 5**

# HAND AND POWER TOOLS

**III**

**OBJECTIVE 20e**

**Operate a gasoline-powered backpack mist blower.**

**TOOLS AND MATERIALS**

- Backpack mist blower
- Operating instructions
- Water
- Chemicals, if desired
- Protective clothing: Rain gear or waterproof clothing, including hat; goggles or face shield, unlined neoprene gloves and boots

  WARNING **Muffler will burn clothing; wear close-fitting clothing and check for safe clearance.**

**PROCEDURE**

1. Read operating manual for instructions and safety precautions.
2. Check that equipment is in good working order.
3. If chemical is used, read label for directions and safety precautions.
4. Pour into tank 1/2 to 2/3 recommended amount of water, according to instructions on chemical label.
5. Add recommended amount of chemicals through screen.
6. Add remaining amount of water.
7. Set output regulator from 1-4 according to instructor's directions.

   NOTE: Regulator adjusts output quantity or droplet size.
8. Move to spray area.
9. Start engine.
10. Put on unit.

**WARNING** **Muffler will burn clothing; check for safe clearance.**

11. Adjust throttle; level on rear left-hand side adjusts speed of engine; increases or reduces strength of blast.

12. Begin spraying.

13. If blast knocks over plants or blows soil out of containers, reduce throttle.

    **WARNING** **Do not spray toward other people.**

14. Do not walk into spray: spray to the side, or spray walking backwards.

15. Spray until chemical manufacturer's recommendations are met.

    EXAMPLES: Until saturated, until leaves are covered with chemical, until chemical drips off leaves.

16. Shut off sprayer: Reduce throttle speed, until engine dies or press kill switch, if so equipped.

17. Remove backpack being careful of muffler area.

    **WARNING** **Muffler is hot and will burn skin and clothing.**

18. If finished using chemicals:

    a. Properly dispose of excess chemicals according to instructions on chemical label.

    b. Check chemical label for neutralizing agents or dilutants, and follow directions.

    c. Flush and clean tank, hose and nozzles with soap and water according to mist-blower manufacturer's directions.

19. Have your instructor check your work.

20. Put away tools and materials and clean the work area.

**PRACTICAL TEST 1**

## HAND AND POWER TOOLS

**III**

**JOB SHEET 1**

**Trim with an edger.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Read manual for safety and operating procedures. | _____ | _____ |
| 2. Moved edger to the selected location. | _____ | _____ |
| 3. Checked edger before operating: | | |
| a. Gas-powered model | | |
| (1) Checked oil level. Adjusted if needed, following manufacturer's recommendations | _____ | _____ |
| (2) Checked fuel level. Filled as needed. | _____ | _____ |
| (3) Checked that guard was in place and working properly | _____ | _____ |
| b. Electric model | | |
| (1) Checked power cord, extension cord and electrical connectors. | _____ | _____ |
| (2) Repaired or replaced as needed. | _____ | _____ |
| (3) Checked that guard was in place and working properly. | _____ | _____ |
| 4. Checked the depth adjustment of the cutter; reset as needed. | _____ | _____ |
| 5. Cleared the work area of rocks, sticks, and other debris. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 6. Made sure area is clear of people and animals. | ____ | ____ |
| 7. Put on safety glasses and ear protection. | ____ | ____ |
| 8. Started the edger | | |
| a. Gas-powered model | | |
| (1) Connected spark plug wire, if disconnected. | ____ | ____ |
| (2) Pulled out the choke. | ____ | ____ |
| (3) Grasped starter handles and pulled the rope quickly. | ____ | ____ |
| (4) Returned rope slowly. | ____ | ____ |
| (5) Repeated until the motor started. | ____ | ____ |
| b. Electric model | | |
| (1) Made sure all switches are in OFF position. | ____ | ____ |
| (2) Tied and connected power cord and extension cord. | ____ | ____ |
| (3) Connected extension cord to power source. | ____ | ____ |
| (4) Turned power switch to ON position. | ____ | ____ |
| (5) Pressed starter switch. | ____ | ____ |
| 9. Placed wheels on the paved surfaces. | ____ | ____ |
| 10. Engaged blade and allowed it to spin freely before moving into turf. | ____ | ____ |
| 11. Operated the edger so that the protective guard guide was positioned between the walk and the rotary blade. | ____ | ____ |
| 12. Did not allow the rotating blade to contact the concrete walk or drive. | ____ | ____ |
| 13. Kept a firm hold on the handle and walked slowly, moving tool along edge of paved surface. | ____ | ____ |
| 14. If the tool slowed, backed it up an inch or two until the blade came up to normal speed. | ____ | ____ |
| 15. Turned switch to OFF position, stopped motor when job was completed. | ____ | ____ |
| 16. Disconnected equipment: | | |
| a. Gas-powered model—Disconnected spark plug wire. | ____ | ____ |
| b. Electric model—Unplugged edger and neatly coiled extension cord. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 17. Allowed equipment to cool as work area was cleaned. | | |
| a. Swept sidewalk area and raked lawn area. | ____ | ____ |
| b. Loaded grass cuttings into plastic bags. | ____ | ____ |
| c. Closed plastic bags and removed them. | ____ | ____ |
| 18. Cleaned all tools and equipment. | ____ | ____ |
| 19. Returned tools and materials to proper storage area. | ____ | ____ |
| 20. Used proper tools correctly. | ____ | ____ |
| 21. Performed steps in a timely manner. | ____ | ____ |
| 22. Practiced safety rules through procedure. | ____ | ____ |
| 23. Provided satisfactory responses to questions asked. | ____ | ____ |
| 24. Put away tools and properly stored equipment. | ____ | ____ |

## EVALUATOR'S COMMENTS

________________________________________

________________________________________

________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Started edger | 4 | 3 | 2 | 1 |
| Operated edger | 4 | 3 | 2 | 1 |
| Shut off edger | 4 | 3 | 2 | 1 |
| Cleaned work area | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**JOB SHEET 2**

**Operate a front-tine rotary tiller.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Read manual for safety and operating procedures. | ____ | ____ |
| 2. Moved tiller to the selected location. | ____ | ____ |
| 3. Checked engine oil level; adjusted according to manufacturer's recommendations, if needed. | ____ | ____ |
| 4. Checked fuel level; filled as needed. | ____ | ____ |
| 5. Checked that guard was in place and working properly. | ____ | ____ |
| 6. Cleared work site of stones, sticks, and other objects. | ____ | ____ |
| 7. Placed tiller at one end of the section. | ____ | ____ |
| 8. Made sure the tine control lever was disengaged. | ____ | ____ |
| 9. Adjusted the depth control. | ____ | ____ |
| 10. Pulled out the choke. | ____ | ____ |
| 11. Grasped the starter handle and pulled rope out quickly. | ____ | ____ |
| 12. Returned rope slowly. | ____ | ____ |
| 13. Repeated until engine started. | ____ | ____ |
| 14. Pushed choke in slowly. | ____ | ____ |
| 15. Stood behind tiller and increased throttle to appropriate speed. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 16. Engaged tine control lever to begin tilling. | _____ | _____ |
| 17. Let tiller pull itself forward. | _____ | _____ |
| 18. Controlled speed by moving handles up or down. | _____ | _____ |
| 19. Turned the tiller 180° | | |
| a. Released lever to disengage the tines. | _____ | _____ |
| b. Turned machine, walked behind it. | _____ | _____ |
| c. Pulled lever to handlebar and engage tines. | _____ | _____ |
| 20. Repeated operating and turning the tiller. | _____ | _____ |
| 21. Stopped engine when job was complete. | | |
| a. Released the tine control lever to disengage tines. | _____ | _____ |
| b. Slowed engine speed. | _____ | _____ |
| c. Turned switch to OFF. | _____ | _____ |
| d. Moved depth control bar to travel position (all the way up). | _____ | _____ |
| 22. If needed, reset depth of tines to a dig deeper and repeated the operation. | _____ | _____ |
| 23. Allowed tiller to cool. | _____ | _____ |
| 24. Disconnected spark plug. | _____ | _____ |
| 25. Cleaned dirt and debris from tines and tiller. | _____ | _____ |
| 26. Used proper tools correctly. | _____ | _____ |
| 27. Performed steps in a timely manner. | _____ | _____ |
| 28. Practiced safety rules throughout procedure. | _____ | _____ |
| 29 Provided satisfactory responses to questions asked. | _____ | _____ |
| 30. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Started tiller | 4 | 3 | 2 | 1 |
| Operated tiller | 4 | 3 | 2 | 1 |
| Turned tiller | 4 | 3 | 2 | 1 |
| Stopped tiller | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

____________________

____________________

____________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 3**

## HAND AND POWER TOOLS

**III**

**JOB SHEET 3**

### Operate a rear-tine rotary tiller.

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Read manual for safety and operating procedures. Located all controls. | ____ | ____ |
| 2. Moved tiller to the selected location. | ____ | ____ |
| 3. Checked engine oil level; adjusted according to manufacturer's recommendations, if needed. | ____ | ____ |
| 4. Checked fuel level; filled as needed. | ____ | ____ |
| 5. Checked that guard was in place and working properly. | ____ | ____ |
| 6. Cleared work site of stones, sticks, and other objects. | ____ | ____ |
| 7. Placed tiller at one end of the plot. | ____ | ____ |
| 8. Placed the tine control lever (PTO clutch lever) in NEUTRAL or DISENGAGE position. | ____ | ____ |
| 9. Placed the wheel control lever in NEUTRAL position. | ____ | ____ |
| 10. Adjusted the tine depth control to the appropriate depth. | ____ | ____ |
| 11. Pulled out the choke. | ____ | ____ |
| 12. Started engine. | ____ | ____ |
| 13. Slowly pushed the choke in. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 14. Stood behind the machine and engaged the tine control lever (PTO clutch lever). | ____ | ____ |
| 15. Increased throttle to appropriate speed. | ____ | ____ |
| 16. Placed the speed selector in the SLOW position. | ____ | ____ |
| 17. Placed the wheel control lever in the FORWARD position. | ____ | ____ |
| 18. Guided the tiller using the handle bars. | ____ | ____ |
| 19. Let the tiller move itself forward. Did not try to push or force the machine. | ____ | ____ |
| 20. Turned the tiller: | | |
| a. Slowed the engine. | ____ | ____ |
| b. Lifted tines from the soil by raising handlebars. | ____ | ____ |
| c. Placed the wheel control lever in NEUTRAL position. | ____ | ____ |
| d. Placed the tine control lever in NEUTRAL or DISENGAGE position. | ____ | ____ |
| e. Placed the wheel control lever in FORWARD position. | ____ | ____ |
| f. Swung the tiller around 180 until facing the same direction as the starting point. | ____ | ____ |
| g. Placed the wheel control lever in NEUTRAL position. | ____ | ____ |
| h. Placed tine control lever in ENGAGE position. | ____ | ____ |
| i. Returned the wheel control lever to FORWARD position and resumed tilling. | ____ | ____ |
| 21. Repeated tilling and turning to the instructor's satisfaction. | ____ | ____ |
| 22. Stopped the engine: | | |
| a. Slowed engine speed. | ____ | ____ |
| b. Lifted tines from soil using handlebars. | ____ | ____ |
| c. Placed wheel control lever in NEUTRAL position. | ____ | ____ |
| d. Placed tine control lever in NEUTRAL or DISENGAGE position. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| e. Turned engine switch to OFF position. | ____ | ____ |
| 23. Adjusted tines: if repeating passes, adjusted tine position to dig deeper. If finished tilling, raised tines to travel position (all the way up). | ____ | ____ |
| 24. Allowed tiller to cool. | ____ | ____ |
| 25. Disconnected spark plug wire. | ____ | ____ |
| 26. Cleaned tiller, removed dirt and debris. | ____ | ____ |
| 27. Used proper tools correctly. | ____ | ____ |
| 28. Performed steps in a timely manner. | ____ | ____ |
| 29. Practiced safety rules throughout procedure. | ____ | ____ |
| 30. Provided satisfactory responses to questions asked. | ____ | ____ |
| 31. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Started tiller | 4 | 3 | 2 | 1 |
| Operated tiller | 4 | 3 | 2 | 1 |
| Turned tiller | 4 | 3 | 2 | 1 |
| Stopped tiller | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

____________________________________________

____________________________________________

____________________________________________

____________________________________________

____________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

## PRACTICAL TEST 4

# HAND AND POWER TOOLS

# III

### JOB SHEET 4

**Mix soil medium with a cement mixer.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

### PROCESS EVALUATION

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Read operating manual for instructions and safety precautions. | ____ | ____ |
| 2. Located controls, particularly OFF or KILL SWITCH. | ____ | ____ |
| 3. Gathered materials to the mixing area. | ____ | ____ |
| 4. If using small amounts of fertilizers or nutrients, thoroughly mixed these first in a bowl or bucket to give them enough mass to blend into mixture. | ____ | ____ |
| 5. If using dry peat moss, prepared it for mixing: | | |
| a. Spread a thin layer of peat on floor or mixing table. | ____ | ____ |
| b. Mixed and applied wetting agent according to directions. | ____ | ____ |
| c. Watered thoroughly. | ____ | ____ |
| d. Broke up lumps. | ____ | ____ |
| 6. Placed specified amounts of materials in mixer. | ____ | ____ |
| 7. Added enough water to prevent dust and mixed moisture through the mix with shovel or hoe. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 8. Turned on mixer until well blended. | ____ | ____ |
| 9. Placed wheelbarrow in front of mixer. | ____ | ____ |
| 10. Tested moisture level, if desired: | | |
| a. Turned off mixer. | ____ | ____ |
| b. Allowed mixer to come to a complete stop. | ____ | ____ |
| c. Squeezed a handful of medium to test. | ____ | ____ |
| d. Added water, if needed, and turned mixer on. | ____ | ____ |
| 11. Dumped mixture into wheelbarrow, according to manufacturer's instructions. | ____ | ____ |
| 12. Shoveled into storage containers. | ____ | ____ |
| 13. Stored properly. | ____ | ____ |
| 14. Put away tools and materials and cleaned the work area. | ____ | ____ |
| 15. Used proper tools correctly. | ____ | ____ |
| 16. Performed steps in a timely manner. | ____ | ____ |
| 17. Practiced safety rules throughout procedure. | ____ | ____ |
| 18. Provided satisfactory responses to questions asked. | ____ | ____ |
| 19. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Mixed soil medium | | | | |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 5**

# HAND AND POWER TOOLS

# III

**JOB SHEET 5**

**Operate a gasoline-powered backpack mist blower.**

Student's name ________________________ Date __________

Evaluator's name ________________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

## PROCESS EVALUATION

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Read operating manual for instructions and safety precautions. | _____ | _____ |
| 2. Checked that equipment is in good working order. | _____ | _____ |
| 3. If chemical was used, read label for directions and safety precautions. | _____ | _____ |
| 4. Poured into tank 1/2 to 2/3 recommended amount of water, according to instructions on chemical label. | _____ | _____ |
| 5. Added recommended amount of chemicals through screen. | _____ | _____ |
| 6. Added remaining amount of water. | _____ | _____ |
| 7. Set output regulator from 1-4 according to instructor's directions. | _____ | _____ |
| 8. Moved to spray area. | _____ | _____ |
| 9. Started engine. | _____ | _____ |
| 10. Put on unit. | _____ | _____ |
| 11. Adjusted throttle; level on rear left-hand side adjusted speed of engine; increased or reduced strength of blast. | _____ | _____ |
| 12. Began spraying. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 13. If blast knocked over plants or blew soil out of containers, reduced throttle. | | |
| 14. Did not walk into spray: sprayed to the side, or sprayed walking backwards. | | |
| 15. Sprayed until chemical manufacturer's recommendations were met. | | |
| 16. Shut off sprayer. | | |
| 17. Removed backpack being careful of muffler area. | | |
| 18. If finished using chemicals: | | |
| a. Properly disposed of excess chemicals according to instructions on chemical label. | | |
| b. Checked chemical label for neutralizing agents or dilutants, and followed directions. | | |
| c. Flushed and cleaned tank, hose, and nozzles with soap and water according to mist-blower manufacturer's directions. | | |
| 19. Used proper tools correctly. | | |
| 20. Performed steps in a timely manner. | | |
| 21. Practiced safety rules throughout procedure. | | |
| 22. Provided satisfactory responses to questions asked. | | |
| 23. Put away tools and cleaned work area. | | |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Operated gasoline-powered backpack-mist blower | | | | |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

## HAND AND POWER TOOLS

## III

NAME ______________________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with hand and power tools to their correct definitions.** Write the correct letters in the blanks.

___ 1. Material that allows electricity to flow through it

___ 2. Edges are angled to create a sharp cutting surface

___ 3. To break up and loosen the soil

___ 4. To cut dead or living parts from a plant in order to increase fruit or flower production, to improve the form or to remove dead or diseased parts

___ 5. Sharp particles left on edges after filing or sharpening

___ 6. To till or turn the soil

___ 7. Position of a shovel or spade blade in relation to the handle

___ 8. Metal working part of a hand tool attached to the handle

___ 9. Material that will not allow electricity to flow through it

a. Degree of cant

b. Insulation

c. Aerate

d. Prune

e. Sliver

f. Conductor

g. Head

h. Resistance

i. Burr

j. Keened

k. Cut back

l. Work

m. Beveled

n. Cultivate

**NOTE:** You must score 100 percent on this safety test.

**OBJECTIVE 2** **State ten safety rules for using hand tools.**

**OBJECTIVE 3**

**Match hand tools to their uses.** Write the correct letter(s) in the blanks.

___ 1. Used for trimming and shaping hedges and simple pruning jobs

___ 2. Used for cutting soil, digging trenches with straight sided, digging narrow holes for planting trees and shrubs, and for cutting turf

___ 3. Used to turn soil in lawn and garden areas

___ 4. Used to water hanging baskets and areas out of reach

___ 5. Used to make a small hole in soil mix to plant seeds or transplant seedlings

___ 6. Container attached to the end of a hose to supply measured amounts of liquid fertilizer or pesticides to plants

___ 7. Used to apply fertilizers, herbicides and pesticides in borders, gardens and medium-size lawns

___ 8. Used for digging holes, filling and covering around single plants

___ 9. Used for cutting, trimming and thinning

___ 10. Used to remove branches that are out of reach

a. Compressed-air sprayer
b. Knife
c. Herbaceous cutter
d. Pole pruner and saw
e. Straight shovel
f. Garden fork
g. Hedge shears
h. Extension saw
i. Hand trowel
j. High-volume sprayer
k. Dibble
l. Spade
m. Wand
n. Stripper
o. Hose-end sprayer

___11. Sharp, pointed hollow pole that sticks into the ground and supplies nutrients and minerals to the roots of a plant

___12. Used for leveling a garden or lawn area

___13. Used to gather fallen leaves, collect grass cuttings, and to mix lime, fertilizer and grass seeds into newly seeded lawn areas

___14. Used for making holes and

removing soil to plant fall bulbs

___15. Used for digging deep, narrow holes to plant trees and shrubs

___16. Used for weeding and leveling soil in a flower or vegetable garden

___17. Used for lifting large quantities of light materials such as mulch, sawdust, soil mix, snow and light trash

___18. Used for lifting heavy materials such as sand, gravel, concrete and rocks

___19. Used for digging, lifting loose

sand and soil, scooping and preparing planting holes

___20. Used for digging in hard soil or roots; with a moderate cant, can also be used to move or carry soil

p. Leaf rake

q. Bulb planter

r. Leveling hoe

s. Post hole digger

t. Root feeder

u. Garden rake

v. Garden hoe

w. Scoop shovel

x. Straight-edge shovel

y. Pointed shovel

z. Cutting shovel

aa. Materials shovel

bb. Round-nose shovel

cc. Square-nose shovel

dd. Tree planter

__ 21. Used to trim grass and weeds growing around small trees and seedlings

__ 22. Used to separate one growing area from another

__ 23. Used for weeding and cultivating around shrubs, flowers, and vegetables

__ 24. Used for pruning branches from pencil-size to 1 1/4 inch in diameter

__ 25. Used to remove branches larger than 1 1/4 inch in diameter

__ 26. Single-edge blade used for removing small-diameter tree limbs

__ 27. Used to prune small branches no larger than a pencil

__ 28. Used to apply a gentle, uniform spray of water to surface areas containing seedlings or cuttings, or plants

ee. Sprinklers

ff. Hand pruner

gg. 4-tine and 3-prong cultivators

hh. Straight saw

ii. Pruning saw

jj. Ripping saw

kk. Bow saw

ll. Long-handled edger

mm. Water breakers

nn. Lopping shears

oo. Grass clippers

pp. Trimmers

**OBJECTIVE 4**

**Select from a list characteristics of quality tools.** Write an "X" in the blank before each correct statement.

Durability

___ 1. Metal heads are made of stainless or forged steel in one piece.

___ 2. Short handles are more durable than long handles.

___ 3. Metal heads are made of iron in one piece.

___ 4. Handles are made of forged steel, fiberglass or smooth hardwood such as pine or cedar.

___ 5. Handles are made of rolled steel, fiberglass, or smooth hardwood such as hickory or ash.

___ 6. Approved by and stamped with U.S. Steel symbol.

___ 7. Reinforced handles and head are meant for heavy use.

___ 8. Heads are double-plated.

Efficiency

___9. Cutting edges are sharp and will hold an edge after sharpening.

___10. Moving parts work smoothly.

___11. Assembly is simple and fast.

___12. Bearings are made of teflon rather than steel.

Construction

___13. Heads are attached tightly by open socket.

___14. Heads are attached tightly by closed socket.

___15. Screw-on heads have secure lock-ins.

___16. Grains of wooden handles run perpendicular to the force exerted on the tool.

___17. Saw teeth are beveled to provide a good cutting edge.

___18. Grains of wooden handles run in the same direction as the force exerted on the tool.

___19. Cutting edges have no nicks or burrs.

___20. Threaded parts are self-lubricating.

___21. All screws and bolts are placed correctly and securely.

**OBJECTIVE 5**

**Complete procedures for maintaining hand tools.** Write the correct words in the blanks.

1. Keep tools________________________________

2. Keep tools free of____________________________

3. Check tools often and tighten or replace screws, bolts,

_________________and____________________as needed.

4. Sharpen or replace dull_______________ _______________

5. Repair_______________or__________________ tools promptly.

6. Broken tools that cannot be repaired should be ____________

7. Keep moving parts__________________________

8. Oil wooden handles with linseed oil to prevent____________

and____________________

**OBJECTIVE 6**

**Complete rules for storing hand tools.** Write the correct words in the blanks.

1. Hand tools, especially those with____________ __________,

should be____________ rather than stored in a drawer or on a shelf.

2. ____________should be protected.

3. Keep tools in their_________________________

4. Tools should not be placed where they can_______________

________________________________________________

5. Large tools should be placed__________________________

________________________________________________

6. All tools must be stored_______________ and____________

**OBJECTIVE 7**

**Match correct use of the body with specific tools.** Write the correct letters in the blanks.

___ 1. Raise tool high and let its own weight carry it into the ground, rather than using force with arms and back; use short strokes to cut weeds and loosen clods

___ 2. Use short strokes to avoid back strain and strained joints

___ 3. Avoid back injury: do not try to lift loads that are too heavy; use legs and wrists rather than twisting the back

a. Post hole digger

b. Rakes and cultivators

c. Shovels

d. Saws

e. Hoes

**NOTE:** You must score 100 percent on this safety test.

**OBJECTIVE 8**

**State fuel safety practices for power equipment.** List ten safety practices.

**NOTE:** You must score 100 percent on this safety test.

**OBJECTIVE 9**

**State safety rules for operating power equipment.** List fifteen safety rules.

NOTE: You must score 100 percent on this safety test.

**OBJECTIVE 10**

**State safety rules for operating electric power tools.** List twelve rules.

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**OBJECTIVE 11**

**State safety rules for specific pieces of equipment.**

1. Rotary tiller (list three rules)—

2. Chipper/shredder (list three rules)—

3. Weed cutter (list two rules)—

4. Edger (list three rules)—

5. Lawn mower (list three rules)—

6. Backpack mist blower (list four rules)—

**OBJECTIVE 12**

**Match power tools with their uses.** Write the correct letter in the blanks.

___ 1. Used to mow tall grass, tough seed stalks and weeds and for turfs that don't require extremely high-quality mowing; a single spinning blade cuts to a desired height

___ 2. Used to cut grass and weeds along curbs and sidewalks; electric and gas

___ 3. Used for medium and heavy cultivation 1" to 8" deep and to break untilled ground; usually has a powerful small engine; bulky and hard to use in small areas; gas powered

___ 4. Used to make large quantities of soil or soilless media or to mix plant nutrients; gas powered

___ 5. Used to raise humidity in specific areas of a greenhouse; to apply foliate fertilizers or growth regulators; hose range and pressure depend on specific model; gas or electric

___ 6. Used for light and medium cultivation 1" to 6" deep in vegetable and flower beds; will not break untilled ground, but is effective on previously tilled soil; does not work well in rocky or hard soils; chops mulch; gas powered

___ 7. Used to cut herbaceous twigs, weeds and grass with a whirling nylon line; gas or electric

___ 8. Used to shear and trim hedges; gas or electric

___ 9. Used to cut plant waste into small pieces; gas or electric

a. Rotary lawn mower

b. Weed cutter

c. Leaf blower

d. Mist blower

e. Front-tine rotary tiller

f. Reel mower

g. Hedge shears

h. Dethatcher

i. Rear-tine rotary tiller

j. Mid-tine rotary tiller

k. Edger

l. Concrete mixer

m. Chipper/ shredder

n. Reel mower

|  |  |  |
|---|---|---|
| **NOTICE** | The following assignment sheets and job sheets are not part of the written test. If these activities have not been completed, check with your instructor. |  |
| **OBJECTIVE 13** | **Explain hand-tool safety rules.** | SCORE ________ |
| **OBJECTIVE 14** | **Identify hand tools.** | SCORE ________ |
| **OBJECTIVE 15** | **Explain power-tool safety rules.** | SCORE ________ |
| **OBJECTIVE 16** | **Identify power tools.** | SCORE ________ |
| **OBJECTIVE 17** | **Demonstrate the ability to** |  |
|  | **a. Trim with an edger.** | RATING _______ |
|  | **b. Operate a front-tine rotary tiller.** | RATING _______ |
|  | **c. Operate a rear-tine rotary tiller.** | RATING _______ |
|  | **d. Mix soil medium with a cement mixer.** | RATING _______ |
|  | **e. Operate a gasoline-powered backpack mist blower.** | RATING _______ |

## WRITTEN TEST ANSWERS

## HAND AND POWER TOOLS III

**OBJECTIVE 1**

1. f
2. m
3. n
4. d
5. i
6. l
7. a
8. g
9. b

**OBJECTIVE 2**

Answer must include ten of the following:

- Always use a tool as it is designed to be used
- Stay alert any time you use hand tools or power tools
- Keep tools in their proper places
- Do not leave tools on the floor or on the ground near work site
- Put tools down with tines facing into the ground
- Inspect tools before use and often during use
- Keep cutting edges sharp
- Store sharp or pointed tools in a place where you will not stab yourself with them
- Hold pruners and loppers straight while cutting; twisting will damage tools and plants
- Locate all underground utility lines and pipes before digging
- Wear appropriate clothing for the job

**OBJECTIVE 3**

1. g
2. l
3. f
4. m
5. k
6. o
7. a
8. i
9. b
10. d
11. t
12. u
13. p
14. q
15. s
16. v
17. w
18. cc
19. bb
20. y
21. oo
22. ll
23. gg
24. nn
25. ii
26. kk
27. ff
28. mm

**OBJECTIVE 4**

1, 5, 7, 9, 10, 14, 17, 18, 19, 21

**OBJECTIVE 5**

1. clean
2. rust
3. handles, heads
4. cutting edges
5. broken, damaged
6. disposed of
7. oiled
8. drying, splitting

**OBJECTIVE 6**

1. Sharp (or cutting) edges, hung
2. cutting edges
3. proper places
4. roll off benches or tables
5. out of traffic paths

6. clean and dry

**OBJECTIVE 7**

1. e
2. b
3. c

**OBJECTIVE 8**

Answer must include ten of the following:

- Mix and pour fuels outdoors
- Use only fuel or fuel mixture recommended for each tool
- Never smoke while mixing and pouring fuels
- Use only approved fuel containers
- Never store fuel indoors where fumes can be ignited by a flame or spark
- Wipe up all spills on machinery and drives
- Move away from a spill area, wipe off excess fuel and allow fuel to evaporate from equipment before starting the engine
- Never remove the gas cap or add fuel when the engine is running or hot
- Always allow the engine to cool before transporting or storing a tool
- Empty the fuel tank before storing a tool
- Operate equipment only in a well-ventilated area

**OBJECTIVE 9**

Answer must include fifteen of the following:

- Read, understand and follow the warnings and instructions in the operating manual before using any tool; know all controls and how to operate them
- Review manuals at the beginning of each season
- Check machine and make all adjustments **before** turning on the power
- Check safety shields and keep them in place during operation

- Never operate power equipment when you are tired, ill, or under the influence of alcohol, drugs, or medications
- Make sure there are no people or animals in the operating area or where materials or objects might be thrown
- Remove all debris from the area before operating
- Do not leave a running machine unattended
- Know how to start and stop machine before operating
- Turn off equipment immediately when it overheats
- Stop engine before cleaning, fueling, or making adjustments
- Keep hands, feet, and clothing away from moving parts
- Always wear heavy, long pants and boots
- Wear gloves, safety glasses, and ear protection when needed
- **Do not wear gloves** when hands are near moving parts
- Remove jewelry and tie long hair back
- Wear close-fitting clothing

**OBJECTIVE 10**

Answer must include twelve of the following:

- Always use properly grounded plugs and cords
- Use only the voltage supply recommended for a tool
- Do not use near flammable liquids
- Do not use in wet conditions
- Check cords and plugs for breaks in the insulation
- Use extension cords designed for outdoor use and tie to power cord
- Never carry a power tool by the cord
- Use cords heavy enough to carry the full current
- Do not expose cords to heat, oil, or sharp edges
- Avoid contact with a grounded conductor
- Do not touch the starter while connecting an extension cord

- Unplug a tool when it is not in use
- Disconnect power before checking, adjusting, oiling, or cleaning
- Keep tool housing free of debris to prevent motor overheating

**OBJECTIVE 11**

Answers must include the following

1. Rotary tiller—
   - Do not till near underground electric cables, pipes or hoses
   - Clear tines often
   - Do not operate on a steep slope
2. Chipper/shredder—
   - Wear safety glasses or face shield
   - Use the proper tool to push material into the shredder (Never push material into the machine with your hands.)
   - Stay away from the machine after the engine is shut off (The hammers keep rotating for 40-60 seconds or more.)
3. Weed cutter—
   - Wear safety glasses or face shield
   - Keep cutter away from your body (high-speed rotating string will cut through clothing and skin.)
4. Edger—
   - Wear safety glasses or face shield
   - Keep feet and hands away from cutting blade
   - Keep blade from hitting cement walks or curbing or other solid surfaces
5. Lawnmower—
   - Clear lawn of debris (thrown objects travel at high speeds and can cause serious injury)
   - Mow so that the discharge faces away from people and windows

- Turn mower off when moving across non-grassy areas

6. Backpack mist blower—
   - Do not spray on windy days
   - Never spray toward other people
   - Never walk into spray
   - Know the chemicals you use and their hazards

**OBJECTIVE 12**

1. a
2. k
3. i
4. l
5. d
6. e
7. b
8. g
9. m

**OBJECTIVE 13** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 14** Refer to answers to Assignment Sheet 2.

**OBJECTIVE 15** Refer to answers to Assignment Sheet 3.

**OBJECTIVE 16** Refer to answers to Assignment Sheet 4.

**OBJECTIVE 17** Refer to answers to Assignment Sheet 5.

**OBJECTIVE 18** Refer to answers to Assignment Sheet 6.

**OBJECTIVE 19** Refer to answers to Assignment Sheet 7.

**OBJECTIVE 20** Refer to Practical Tests for Job Sheets 1 through 5.

**OBJECTIVE SHEET**

# INTRODUCTION TO SAFETY

# IV

## INTRODUCTION

You can't underestimate the need for safety on the job. Forgetting or ignoring safety rules and precautions can cause injury, permanent disability, time and money lost from your job, and damage to tools and property. Learn, remember and follow the safety precautions and safety rules in this unit, and you should be able to do your job safely and prevent accidents.

## UNIT OBJECTIVE

After completing this unit, the student should know safety rules for proper dress, protective clothing, hand tools, and working with electricity; and be able to identify standard safety color codes and fire extinguishers. The student will demonstrate these competencies by completing the assignment sheet, job sheets, practical tests, and a written test with 100 percent accuracy.

## SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with safety to their correct definitions.
2. State the major causes of accidents.
3. State general job-safety rules.
4. Describe the purpose of protective clothing.
5. Complete statements about dress precautions.
6. Distinguish among federal safety code colors.
7. Determine type of fire extinguisher required to put out specific types of fires.
8. Select from a list precautions to avoid a lightning strike.
9. Match terms associated with electrical safety to their correct definitions.
10. Distinguish between voltage applications.
11. Complete electrical safety rules.
12. Match electrical protection devices to their correct descriptions.

13. Label three-wire receptacles.

14. Complete safety rules for using tools.

15. State safety rules for the work area.

16. Analyze greenhouse safety. (Assignment Sheet 1)

17. Demonstrate the ability to

    a. Lift a heavy object correctly. (Job Sheet 1)

    b. Operate a fire extinguisher. (Job Sheet 2)

## SUGGESTED ACTIVITIES

## INTRODUCTION TO SAFETY IV

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Order materials to supplement unit.
- Invite a Fire Safety Education Officer to discuss fire safety and electrical safety and demonstrate how to operate fire extinguishers. Some fire departments offer a workshop in fire extinguisher use. Contact a large fire department for information.
- Invite a physician, chiropractor or osteopath to discuss back injuries and simple anatomy and the statistics and costs of back injuries.

  **NOTE:** Supply guest speakers with the Objective sheet, Information sheet, and any other components you want them to cover.
- Arrange to visit another shop to examine federal color code use.
- Arrange with a commercial greenhouse for students to evaluate greenhouse safety (Assignment Sheet 1).
- Invite a Red Cross first-aid instructor to talk to the class. First-aid is an essential part of safety and should be taught only by a certified instructor. Encourage students to take Red Cross first-aid training and CPR.

**DELIVERY**

**Objective 1**

- Show film *Shake Hands with Danger*.
- Display safety signs and posters

- Discuss the need for safety and share your own experiences in safe and unsafe practices in the greenhouse, in the field, with tools, with electricity, and with protective clothing and appropriate dress.
- Review terms and definitions with students.

**Objective 2**

- Share your experiences and encourage students to share their experiences with improper use of tools. Review safety posters in the greenhouse and classroom area.

**Objective 3**

- Point out locations of fire extinguishers and first-aid kit.
- Have students go to other areas of the school or campus and locate fire extinguishers and first-aid kits.
- Distribute Supplement 1—Lift Heavy Objects Safely.
- Have a physician, chiropractor, or osteopath discuss back injuries.
- Have students complete Job Sheet 1—Lift a heavy object correctly. Give them plenty of practice opportunities.

**Objectives 4 and 5**

- Discuss and demonstrate proper clothing and protective clothing.
- Show film *It's Up to You on Eye Safety*.

**Objective 6**

- Take students through your shop area and locate color code markings. Discuss their use and applications.
- Visit another shop and examine use of the federal color code.

**Objective 7**

- Show film *Safety on the Job: Fire Extinguishers*.
- Show videotape *Fire Safety: Extinguishers*.
- Have students examine fire extinguishers in your building to determine the type.

- Have a Fire Safety Education Officer discuss fire safety and demonstrate the use of fire extinguishers.
- Take students to a fire extinguisher training session, if possible.
- Discuss activity sheets:

  Supplement 2—How Fires Burn and How Extinguishers Work

  Supplement 3—Types of Fire Extinguishers

  Supplement 4—Stop, Drop and Roll

**Objectives 8 through 13**

- Show film *The Path of Least Resistance*.
- Show videotape *Electrical Safety*.
- Refer to Unit III, "Hand and Power Tool Safety," for additional safety precautions, rules, and resources.
- Demonstrate types of plugs and outlets.
- Have students examine outlets in the building and determine their voltage and amp rating.
- Illustrate a UL tag and discuss approved electrical practices.

**Objectives 14 and 15**

- Show films, *Shake Hands with Danger* and *Safety in the Shop: Basic Practices*.
- Refer to Unit III, "Hand and Power Tool Safety," for additional safety precautions and rules and resources.
- Show damaged tools and explain how they got that way.
- Share with students the costs of tool maintenance and replacement.
- Demonstrate safe use and common misuse of tools.
- Have students complete Supplement 1—Safety Crossword Puzzle.

## APPLICATION

**Objective 16**

- Have students share the observations of another facility.
- Use Assignment Sheet 1—Analyze Greenhouse Safety to increase safety awareness in the greenhouse.

**Objectives 17 and 18**

- Use Job Sheet 1—Lift a Heavy Object Correctly to give students practice and competence in safe lifting techniques and to prevent back injuries.
- Use Job Sheet 2—Operate a Fire Extinguisher to give students hands-on practical experience with fire extinguisher operation. Since it is impractical to have students exhaust the extinguisher, have them state the step that is not completed.

## EVALUATION

**Practical test**

- Determine if student followed correct procedure on each job sheet.
- Evaluate the quality of each product using the criteria given.
- Demonstrate the procedure again and retest if necessary.

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

### Audiovisual Materials

- *Electrical Safety*. 16mm, color, 30 min., International Film Bureau, Inc., 1983. Stresses the importance of safety procedures when working with electricity. Explains the path that electricity follows and, once intercepted by human contact, the damage it can cause to that person if help is not available. Order No. F112.
- *Fire Safety: Extinguishers*. 16mm, color, 15 min., Aims Industrial Media, 1982. Illustrates the proper use of various types of fire extinguishers. Three main points are stressed: using the right kind of fire extinguisher, in the right way, on the right kind of fire. Order No. F279.
- *It's Up to You*. 16mm, color, 11 min., Harvest Film, Inc., 1960. Award-winning breakthrough film on eye safety. Order No. F167.
- *Safety in the Shop: Basic Practices*. 16 mm, B&W, 14 min., Coronet Films, 1970. Emphasizes the worker's responsibility for safety in using hand and power tools. Explains the importance of a clean shop, proper clothing, correct ways to lift, and ways to guard against fires. Order No. F168.
- *Shake Hands with Danger*. 16mm, color, 22 min., Calvin Productions, 1980. Stresses the importance of safety procedures and shows the consequences that result when these procedures are ignored or overlooked. Order No. F173.
- *The Path of Least Resistance*. 1/2" VHS, color, 15 min., Agency for Industrial Tech., 1986. Emphasizes preventing electrical accidents. Order No. V029.
- *Safety on the Job: Fire Extinguishers*. 1/2" VHS, color, 23 min., Agency for Industrial Tech., 1988. Discusses the four different types of fires and extinguishers and the five types of extinguishing agents. Students learn what to do in a fire emergency before using a fire extinguisher. Order No. V162.

**NOTE:** These items are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Resource Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

**UNIT REFERENCES**

- *Accident Prevention Manual for Industrial Operations*, 7th ed. Chicago, Illinois: National Safety Council, 1974.
- *An Accident Prevention Program for School, Shops, and Laboratories*. State College, Pennsylvania: Department of Vocational Education/Pennsylvania State University, 1967.
- Carlson, Gene P., and William J. Vandervort, eds. *Essentials of Fire Fighting*, 2nd ed., Stillwater, Oklahoma: Fire Protection Publications, Oklahoma State University, 1983.
- *Federal Register*. Vol. 36, No. 105. Pt. 2. Washington, D.C.: United States Department of Labor, 29 May 1971.

**INFORMATION SHEET**

## INTRODUCTION TO SAFETY

## IV

**OBJECTIVE 1**

**Match terms associated with safety to their correct definitions.**

- **Safety**—Freedom from danger, risk, or injury
- **Accident**—Any suddenly occurring, unintentional event that causes injury or property damage
- **Hazard**—Source of danger
- **Carelessness**—Failure to think before one acts; failure to pay attention
- **Combustible**—Capable of bursting into flames
- **Flammable**—Capable of being easily ignited and burning quickly

  **NOTE:** *Inflammable* means "flammable."
- **Extinguish**—To put out a fire; to cause to cease burning
- **Toxic**—Poisonous

**OBJECTIVE 2**

**State the major causes of accidents.**

- Carelessness
- Forgetting or disregarding safety practices
- Not knowing how to operate equipment properly
- Improper use of equipment

**OBJECTIVE 3**

**State general job-safety rules.**

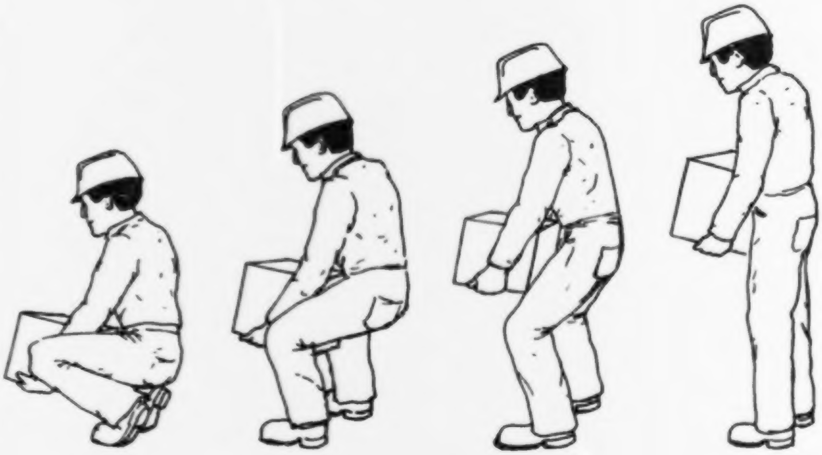
- Keep alert and conduct yourself in a safe manner

  **NOTE:** Nobody likes to work around a person who is careless; that person is a threat to others and to the business or project.
- Be aware of where others are and what they are doing

EXAMPLES: If someone in the greenhouse is spraying pesticides, stay clear. If someone is pouring gasoline, don't smoke.

- Know the location of fire-fighting and first-aid equipment
- Report all accidents to your instructor, no matter how minor they may seem
- Use proper techniques for lifting a heavy object (Figure 1) (Supplement 1, Job Sheet 1)

FIGURE 1



One of the most painful and common on-the-job injuries is damage to back muscles and spine from improper lifting techniques. Other injuries caused by improper lifting include torn or strained muscles, ligaments, or joints in your back, arms, shoulders, neck or legs.

Once injured, these areas never heal completely and, because they are weak, are easily sprained or torn again. These injuries can be avoided by using the simple techniques in Job Sheet 1. Taking a moment to stop and think can save you hours of aches and pains.

Some people try to show off by lifting objects that are too heavy or too awkward to be handled safely, while others are just embarrassed to ask for help. However, the truth is that no one is impressed when the show-off ends up in the hospital, and the embarrassment and inconvenience are much greater when co-workers must do the job of an injured worker.

**OBJECTIVE 4** **Describe the purpose of protective clothing.**

- **Hard-toed, hard-soled shoes**—Protect feet from dropped objects, cutting edges on equipment and from thrown objects
- **Close-fitting clothing**—Prevent clothes from getting caught and tangled or pulled by equipment

  EXAMPLE: A loose shirttail can get caught in rotating parts and pull your body into the machine.

- **Hat**—Protects the head from sun and helps prevent heatstroke
- **Unlined neoprene apron**—Protect skin and clothing when mixing chemicals such as pesticides, herbicides, and fertilizers
- **Unlined neoprene gloves**—Protect hands when handling chemicals

  NOTE: Cloth gloves or lined rubber gloves will hold the chemical against the skin.

- **Unlined neoprene boots**—Protect feet when working with chemicals
- **Safety glasses**—Protects eyes from thrown and flying objects when working with power tools
- **Face shield**—Protect eyes and face from flying or thrown objects

  EXAMPLE: Chipper/shredder machines, weed cutters, and power edgers can throw sticks, branches, and other debris to head level.

- **Respirators**—Prevent inhalation of pesticides and other toxic chemicals during application
- **Hearing protection**—Reduces continued noise levels that can damage hearing

- **Spray suit**—Protects entire body when fogging or spraying highly toxic chemicals

**OBJECTIVE 5**

**Complete statements about dress precautions.**

- Wear clothing and protective gear appropriate for the work to be done
- Tie back long hair before using power equipment or working around moving parts
- Do not wear gloves when hands are around moving parts

  EXAMPLES: Power hedge shears, chipper/shredder
- Remove rings and other jewelry before working with power equipment
- Do not carry tools or sharp objects in your pockets

**OBJECTIVE 6**

**Distinguish among federal safety code colors.**

**Federal safety red**

- Indicates danger
- Identifies fire-protection equipment and its location
- Identifies portable containers of flammable liquids
- Identifies emergency stop buttons and switches on machinery

**Federal safety yellow**

- Indicates caution and marks physical hazards

  EXAMPLES: Low beams, steps, ramps
- Indicates waste containers for explosive or combustible materials
- Indicates equipment that should **NOT** be started, used, or moved

  EXAMPLES: Defective equipment, equipment being serviced

**Federal safety orange**

- Identifies dangerous parts of equipment that could cut, crush, shock, or otherwise injure

**Federal safety purple (or black on safety yellow)**—Indicates radiation hazards

**Federal safety blue**—Identifies tags that indicate equipment should **not** be used or moved

EXAMPLES: Defective equipment or equipment being serviced

**Federal safety green**

- Identifies first-aid equipment and its location
- Identifies safety equipment other than fire-fighting equipment and its location

**Federal safety black and white**

- Indicate traffic flow paths
- Indicate storage areas
- Identify housekeeping equipment and its location

**OBJECTIVE 7**

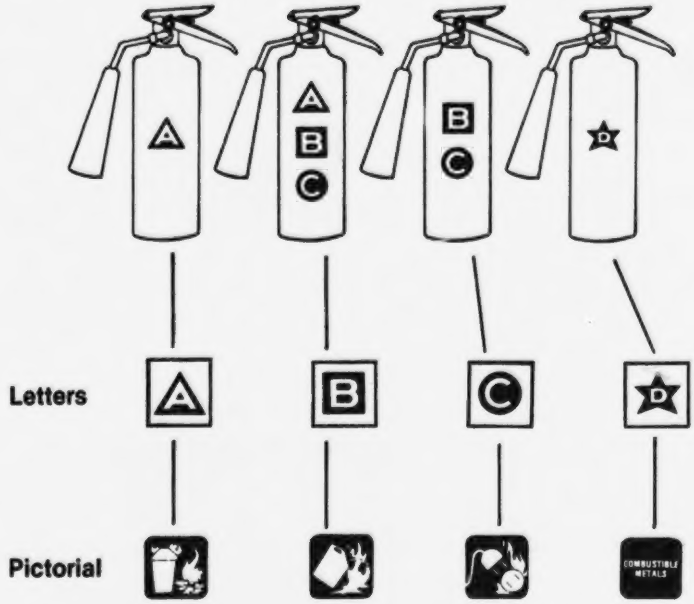
**Determine type of fire extinguisher required to put out specific types of fires.** (Supplements 2, 3, and 4 and Job Sheet 2)

**NOTE:** Fire extinguishers will stop fires on specific types of burning material. Extinguishers are classified according to the material. You must know the right extinguisher to use in each case. Using the wrong type extinguisher may be dangerous. (Figure 2)

Most fire extinguishers today are multipurpose dry-chemical type, effective on Class A, B, and C fires. Other types are APW, air-pressurized water, used for Class A fires; $CO_2$, carbon dioxide, used for Class B and C fires; and halon, an expensive gas used for computer and delicate equipment fires (it doesn't make the mess that water and dry chemicals do); and purple K, a potassium-based dry powder for use on Class D fires.

Check the fire extinguishers in your building and in places you normally visit. Notice the types and classes of fires they will extinguish.

FIGURE 2



- **Class A**—Fires that occur in ordinary combustible materials such as paper, wood, rags, rubber, plastics, chemicals
- **Class B**—Fires that occur with flammable liquids such as gasoline, oil, grease, paint, and solvent

  **NOTE:** Ammonium nitrate fertilizer is combustible. If it is stored too long or comes into contact with acid or oil, it can burn. An AB or ABC extinguisher will put out the fire.
- **Class C**—Fires that occur in or near electrical equipment such as motors, air-conditioning and electric heating units, computers, and electrical wiring
- **Class D**—Fires that occur with combustible metals such as iron, magnesium, and sodium

**NOTE:** Volkswagen engines contain magnesium and create a Class D fire when they burn. In your school and work, it is unlikely that you will be confronted with Class D fires.

A fire requires immediate action. The first step is to determine the correct response. Ask yourself, "What's burning? Can I put it out? If I can, what's the best way?" Sometimes the best response is to get out—**fast.**

When plastic burns—and many other modern materials—it releases highly poisonous fumes. If a plastic green-greenhouse skin catches fire, do not try to fight it, but leave immediately and get up wind of the smoke. Call for professional help.

Chemical fires can be controlled with A, AB, and ABC extinguishers or with water.

**OBJECTIVE 8** **Select from a list precautions to avoid a lightning strike.**

Lightning can strike in a wide area around a thunderstorm, not just where the rain is. It strikes the tallest object in the area—a tree, a power pole, or a person riding a tractor mower on a golf course green.

Lightning takes the pathway with the least electrical resistance, preferring a good conductor such as metal or water, rather than air.

Lightning does not have to strike you directly to burn you. When a tree is hit, the current goes into the ground, so if you are under the tree or near it, you can be hurt. If lightning strikes nearby and you are in the water, you are in danger because the electricity will travel through the ground to the water and through the water to you.

If you are operating metal equipment on ground that's conducting current, you can be the end of the circuit, and suffer serious injury.

- Remain in the car or truck; but do not lean against doors, touch metal parts, or use a CB radio (except for emergencies) during the storm
- Get away from trees, power poles, and power lines

**NOTE:** If you are outside and can't get to a car or a building for shelter, look for a thick clump of low-growing trees, shrubs, or bushes. Stay away from tall trees.

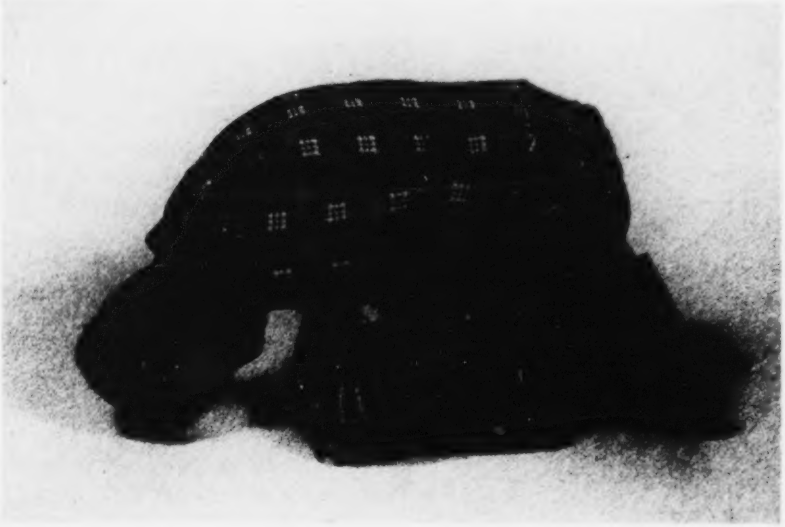
- Move to low ground

EXAMPLES: The foot of a cliff or even at the bottom of a small dropoff; holes

- Kneel, do not lie, on the ground. If you are in the open: (Figure 3)

1. Get down on your knees
2. Put your hands on your knees
3. Tuck your head down

FIGURE 3



By kneeling, you lower your height and reduce the risk of burn area since only your knees and toes are in contact with the ground. If you are standing in an open area, you are a natural lightning rod.

- Get away from metal tools, fences, or other metal objects
- Drop to the kneeling position immediately if you feel your skin tingle or an electric charge that makes your hair stand on end, because lightning may be about to strike you.

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**OBJECTIVE 9**

**Match terms associated with electrical safety to their correct definitions.**

- **Voltage**—A term used to describe the pressure of electricity

  NOTE: Voltage is expressed in volts, the basic unit of electromotive (electrical + motion) force. Common voltages are 120 and 240; or, it can be said that an electrical circuit will furnish 120 volts or 240 volts.

- **Amp (ampere)**—Term used to describe the amount, or strength, of electrical flow through a circuit

  NOTE: Tools normally rate between 2 and 40 amps. The amperage is always listed on the label.

- **Watt**—Term used to describe the rate of electrical output

- **Short**—A disruption in the flow of electricity so that only a part or none of the current gets through the circuit

  NOTE: A short can cause the circuit to burn out and can cause sparks and a fire.

**OBJECTIVE 10**

**Distinguish between voltage applications.**

- **120 v**—Used for small hand tools and equipment such as edgers, trimmers, shears, and small mowers

- **240 v**—Used to run one-half horsepower and larger motors and electrical heaters

**OBJECTIVE 11**

**Complete electrical safety rules.**

- Always make sure power is disconnected before adjusting or servicing an electrical motor or tool

- Always service and use electrical equipment in a dry area

- Always use approved wiring practices

  NOTE: If a hand tool has a three-wire plug, always use a three-wire adapter. Never remove the third prong from a three-wire plug.

- Always use insulated tools and wear protective clothing when working on wiring:

  - Insulated rubber boots and gloves
  - Eye protection

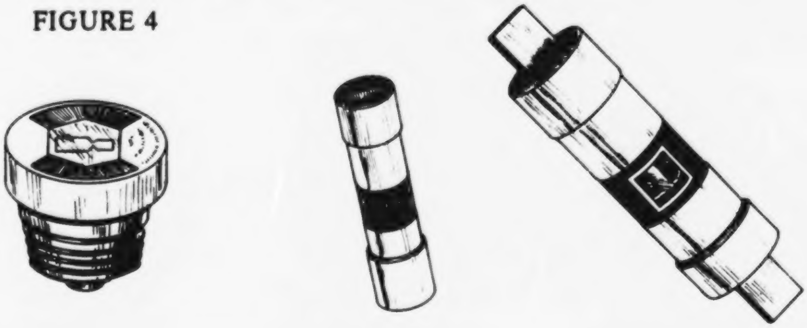
- Always have an approved fire extinguisher nearby when working with electrical equipment or tools

**WARNING Read the instruction on the fire extinguisher before using. Improper care and handling could result in injury.**

**OBJECTIVE 12** **Match electrical protection devices to their correct descriptions.**

- **Fuse**—A wire or strip of easily-melted metal placed in a circuit as a safeguard; when the current becomes too strong, the metal melts, breaking the circuit (Figure 4)

FIGURE 4



Plug fuse

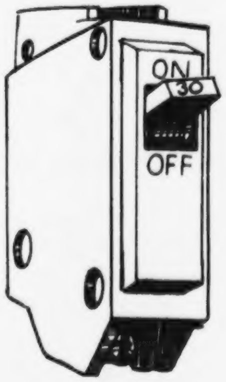
Cartridge fuse (ferrule type)

Cartridge fuse (blade type)

- **Circuit breaker**—Switch-type mechanism that automatically interrupts the flow of electricity when the flow becomes excessive (Figure 5)

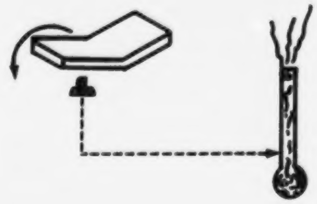
**NOTE:** When a circuit breaker "trips," the breaker should not be reset until after the source of overload has been fixed and the breaker has cooled.

FIGURE 5



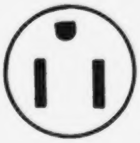
- **Bimetal thermal protector**—A devise built into an electric motor that automatically interrupts an electric circuit if a short occurs or if the motor overheats (Figure 6)

FIGURE 6

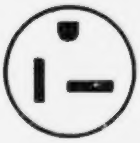


**OBJECTIVE 13** **Label three-wire receptacles.** (Figure 7)

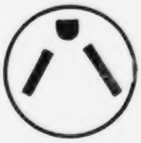
FIGURE 7



120 v - 15 amps



120 v - 20 amp



240 v - 30 amp

**OBJECTIVE 14** **Complete safety rules for using tools.**

- Know how to use or operate a tool properly before using it

  **CAUTION: Read operating manuals for power equipment, follow all safety precautions. Always ask for help if you don't know how a machine works.**

- Use tools as they are intended to be used

  EXAMPLE: Do not use a long-handle shovel as a pry bar. The handle can split or break, causing puncture wounds, sprained muscles, or other injuries.

- Keep tools sharp and well adjusted

  **NOTE:** Accidents happen with dull tools because they require more effort and greater pressure to make them work properly. Fatigue and frustration mixed with greater pushing or pressure can cause a tool to slip and cut, and can cause back injuries or other problems.

- Properly maintain and store all tools
- Tag and report to the instructor any defective tools, machines, or equipment
- Disconnect power equipment from power source before fueling, adjusting, or performing maintenance

  EXAMPLES: Unplug electrical equipment; disconnect spark plug on gas-powered equipment

- Keep guards and safety devices in place and in good working condition

**OBJECTIVE 15** **State safety rules for the work area.**

- Store materials and supplies safely in their proper places
- Store tools and equipment safely in suitable storage areas
- Keep work areas organized and clear of debris and other hazards
- Clear floors of obstacles and slippery substances; clean up spills immediately

  **NOTE:** Plant matter and wet floors are serious hazards in the greenhouse. Watch where you walk.

- Keep aisles, exits, and traffic areas free of materials and debris
- Dispose of combustible and hazardous materials properly

EXAMPLES: Combustibles Gasoline, paint thinner, kerosene

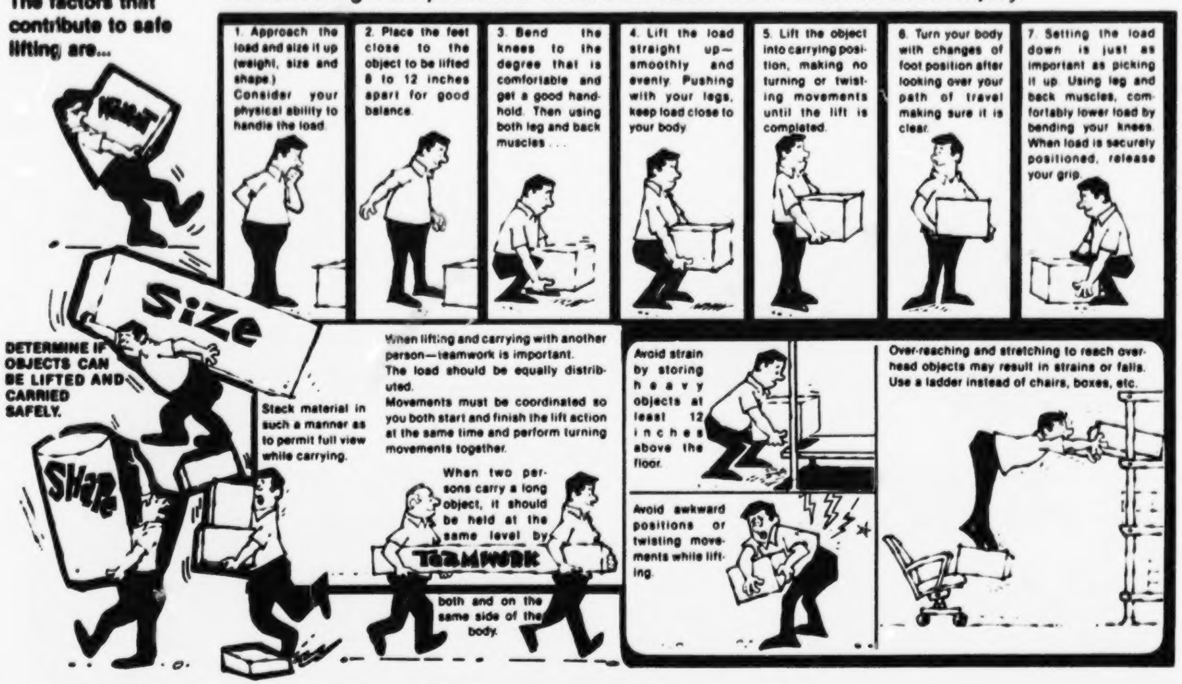
Hazardous materials— Pesticides and herbicides

- Keep enough brooms, brushes, waste containers, and housekeeping supplies on hand to keep the work area clean

# LIFT HEAVY OBJECTS SAFELY

**The factors that contribute to safe lifting are...**

*The following safe practices should be observed in order to avoid injury.*



1. Approach the load and size it up (weight, size and shape.) Consider your physical ability to handle the load.

2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.

3. Bend the knees to the degree that is comfortable and get a good hand-hold. Then using both leg and back muscles . . .

4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body

5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.

7. Setting the load down is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY.

Stack material in such a manner as to permit full view while carrying.

When lifting and carrying with another person—teamwork is important. The load should be equally distributed. Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.

Avoid strain by storing heavy objects at least 12 inches above the floor.

Avoid awkward positions or twisting movements while lifting.

Over-reaching and stretching to reach overhead objects may result in strains or falls. Use a ladder instead of chairs, boxes, etc.

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## HOW FIRES BURN AND HOW EXTINGUISHERS WORK

Fire has to have three elements in order to burn:

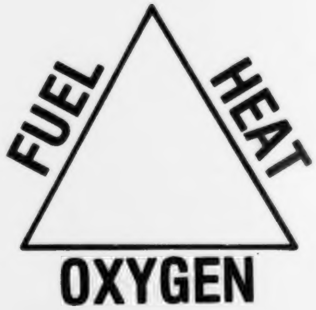
**FUEL**—wood, grease, paper, rubber, plastic, cloth, hair

**OXYGEN**—air

**HEAT**—the fuel has to be hot enough to flame or smolder

## The Fire Triangle

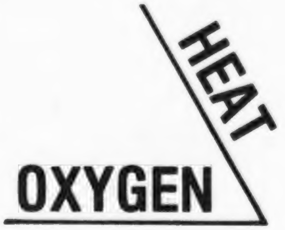
**To produce fire, three things must be present at the same time.**



**If any one of the three is missing, a fire cannot be started. With the removal of any one, the fire will be extinguished.**

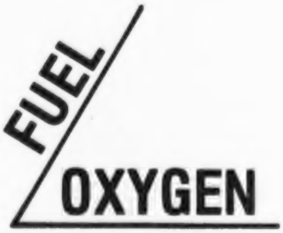
## REMOVE FUEL

Let the fire burn all the fuel; stop the flow of flammable liquids: remove burnable materials from the path of the fire or wet them.



## REMOVE HEAT

Water and $CO_2$ (Carbon dioxide) extinguishers put out a fire by cooling it—removing heat. Water turns to steam, which smothers the fire.



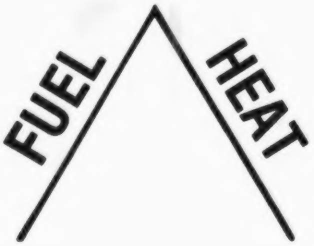
## REMOVE OXYGEN

$CO_2$ (Carbon dioxide) extinguishers put out a fire by cooling and replacing the oxygen with carbon dioxide, smothering it.

Dry chemical extinguishers put out a fire by smothering it.

Halon robs oxygen out of the air by combining with it chemically.

Class D fires require carbon dioxide or nitrogen in the same way that Class A, B or C fires require oxygen. The purple K (potassium) breaks the chemical reaction that allows metals to burn. *Putting $CO_2$* on a Class D fire will make it burn faster and hotter.



## TYPES OF FIRE EXTINGUISHERS

| KIND OF FIRE | | APPROVED TYPE OF EXTINGUISHER | | | | | |
|---|---|---|---|---|---|---|---|
| | | MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT<br>Important: Using the wrong type extinguisher for the fire may be dangerous | | | | | |
| DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . . | THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS | **CARBON DIOXIDE**<br>Carbon Dioxide Gas Under Pressure | **PUMP TANK**<br>Plain Water | **MULTI-PURPOSE DRY CHEMICAL** | **ORDINARY DRY CHEMICAL** | **HALON** | **DRY POWDER** |
| A **CLASS A FIRES**<br>Use These Extinguishers<br>ORDINARY COMBUSTIBLES<br>●Wood ●Paper ●Cloth, etc. | | | | | | | |
| B **CLASS B FIRES**<br>Use These Extinguishers<br>FLAMMABLE LIQUIDS, GREASE<br>●Gasoline ●Paints ●Oils, etc. | | | | | | | |
| C **CLASS C FIRES**<br>Use These Extinguishers<br>ELECTRICAL EQUIPMENT<br>●Motors ●Switches, etc. | | | | | | | |
| D **CLASS D FIRES**<br>Use This Extinguisher<br>COMBUSTIBLE METALS<br>●Iron ●Magnesium | | | | | | | |

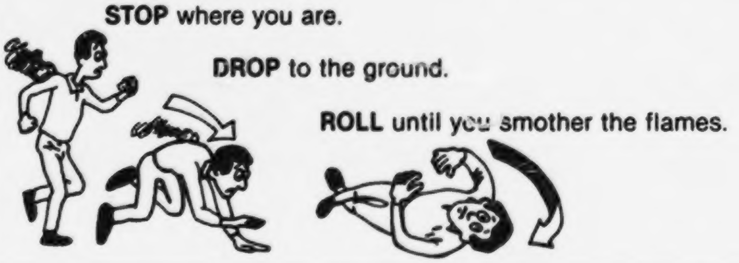
## STOP, DROP AND ROLL

If your clothes catch on fire, ***DO NOT RUN!*** Running will feed more oxygen to the fire, just as blowing on low fires or coals makes them flame up. Instead, use the "Stop, Drop and Roll" technique that has saved thousands of children and adults from more serious injury and death.

Dropping to the floor and rolling smothers the flames. The natural impulse is to run in fear—but in a fire emergency—

You **must keep control** and STOP, DROP, AND ROLL

If your clothes catch fire, *don't run.*



**STOP** where you are.

**DROP** to the ground.

**ROLL** until you smother the flames.

If you are with someone else whose clothes or hair catch on fire, tell the person to STOP, DROP, AND ROLL. Use a blanket, coat or other **non-nylon, non-plastic** fabric to smother the flames.

## SAFETY CROSSWORD PUZZLE

Test yourself on safety terminology by using the clues below to complete the following crossword puzzle.

**ACROSS**

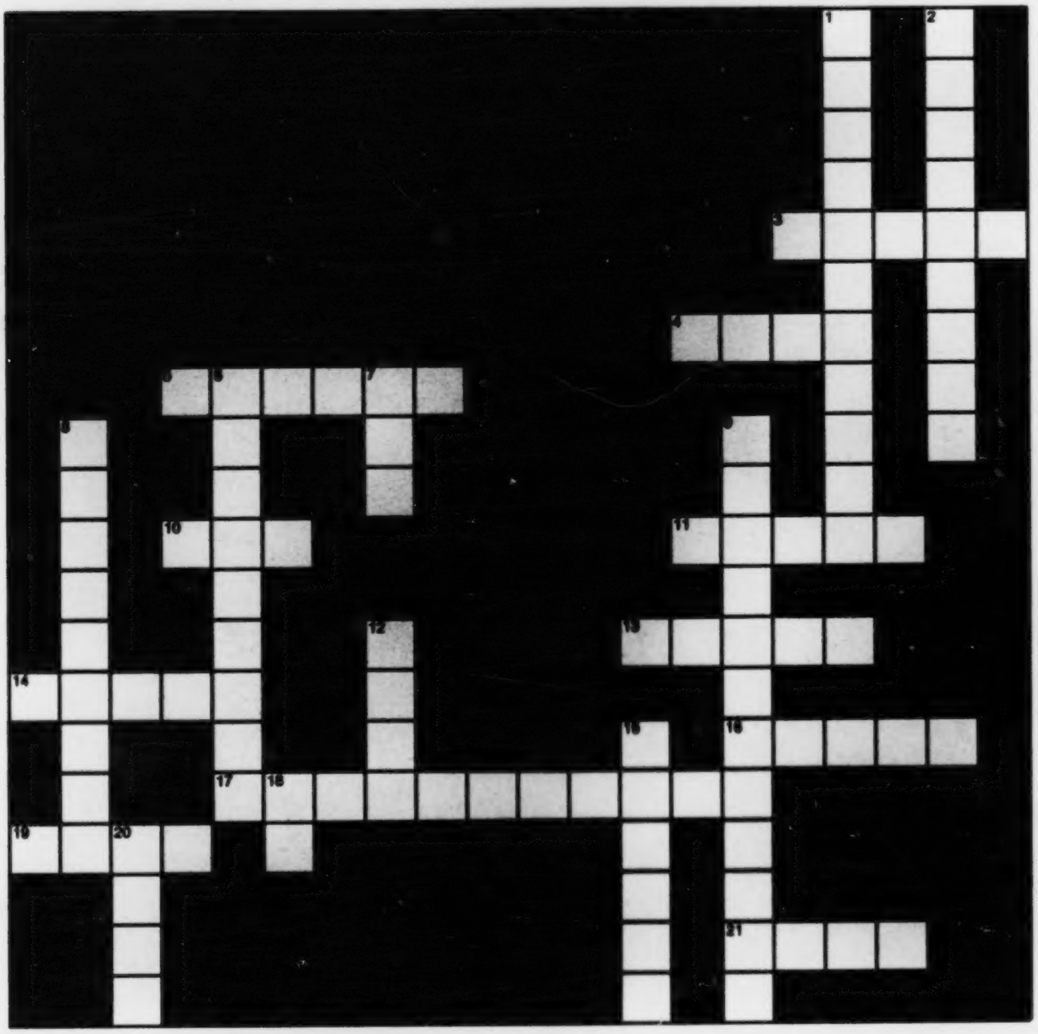
3. Electrical safety devices
4. Term that describes the rate of electrical flow
5. Source of danger
10. Flammable liquid
11. Federal safety color designating location of first-aid equipment
13. In a storm, stay away from power ______
14. Substance in fire extinguisher used on Class A and class B fires
16. Indication of fire
17. Guidelines for job safety (2 wds.)
19. Group that works together toward a common goal
21. Free of danger; secure

---

**DOWN**

1. Capable of bursting into flames
2. Explosively and loudly
6. Suddenly occurring unintentional events that cause injury or property damage
7. The worst thing to do if your clothing or hair catches fire
8. Capable of being easily ignited and burning quickly
9. Negligence; failure to think before one acts
12. ______up spills immediately
15. Explode; burst violently (2 wds.)
18. Fire extinguisher to use on flammable liquids and ordinary combustibles
20. Capable

## Safety Crossword Puzzle


1
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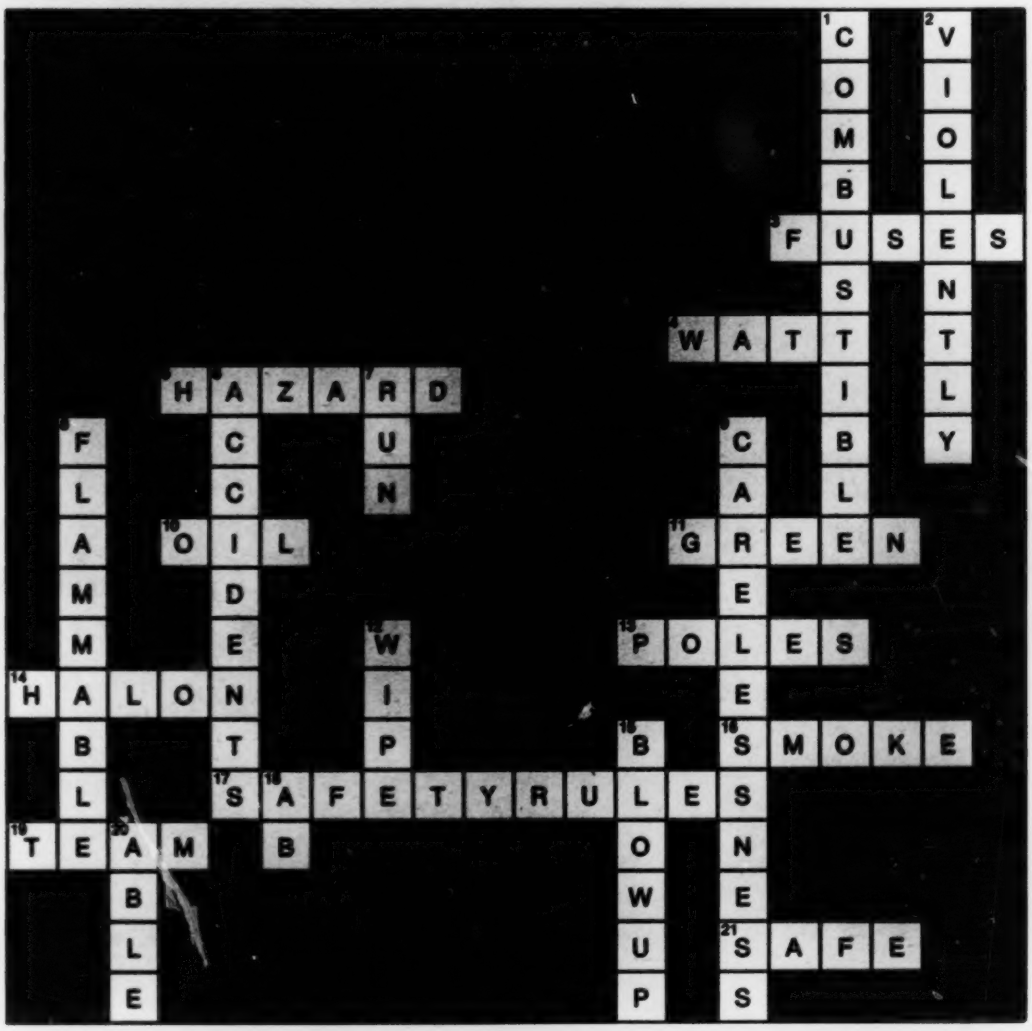
**ACTIVITY 1**

## CROSSWORD PUZZLE ANSWERS


1 COMBUSTIBLE
2 VIOLENTLY
3 FUSES
4 WATT
5 HAZARD
6 ACCIDENT
7 RUN
8 FLAMMABLE
9 CARELESSNESS
10 OIL
11 GREEN
12 WIP
13 POLES
14 HALON
15 BLOWUP
16 SMOKE
17 SAFETYRULES
18 AB
19 TEAM
20 ABLE
21 SAFE

## ASSIGNMENT SHEET 1 — INTRODUCTION TO SAFETY — IV

NAME ______________________________ SCORE ________

**OBJECTIVE 16**

**Analyze greenhouse safety.**

**INTRODUCTION**

Some work areas are clean, orderly, and safe. Others are accidents waiting to happen. Now that you know about safety on the job, in the work area, and in your dress and protective clothing, and you know about electrical safety, you will notice unsafe situations and be able to stop accidents before they can cause injury or damage.

You may also find yourself watching for hazards at home, in businesses, and in other places you visit.

Stay alert! Stay safe!

**DIRECTIONS**

Go through your greenhouse and through a commercial greenhouse and check for and describe hazards and unsafe practices or conditions you find there. Also, record safety practices you observe. Make recommendations for correcting the situation where asked.

**NOTE:** If there is no commercial greenhouse in your area, go to a business that produces a product, such as a manufacturer, auto repair or upholstery shop, or small factory and observe hazards and safety practices. Adapt this form as necessary.

**PART I**

**Report on** Hazards and safety practices in the school greenhouse

**Condition of the floors:**

Look for slick spots, objects or obstacles in the traffic paths, plant matter on the floor, holes, or dangerous steps

______________________________________________

______________________________________________

______________________________________________

**Low-hanging objects:**

______________________________________________

______________________________________________

______________________________________________

Make recommendations for correcting the situation.

______________________________________________

______________________________________________

**Chemical hazards:**

Are chemicals in a separate, locked storage area? Yes No

Are appropriate warning signs in place? Yes No

**Tool safety:**

Check storage, tools lying about, proper use of tools if people are working.

______________________________________________

______________________________________________

______________________________________________

**Heaters:** Vented? Yes No

**Fans:**

Protected with screens or grates to keeps hands and objects out? Yes No

**Fire extinguishers:**

Locate and describe locations.

______________________________________________

______________________________________________

Check pressure indicator. Ready to use? Yes No

Are they placed where you can reach them easily and quickly? Yes No

What types of fire extinguishers are present?

______________________________

**First-aid kit:**

Locate and describe location

______________________________

Is it clearly marked? Yes No

Is it federal safety green? Yes No

**Electrical safety:**

Check visible wiring for breaks and proper ground wire.

______________________________

**Other hazards:**

______________________________

______________________________

______________________________

**Other safety practices you observe:**

______________________________

______________________________

______________________________

______________________________

**Comments and recommendations:**

______________________________

______________________________

______________________________

______________________________

______________________________

______________________________

321

**PART II**

NAME ______________________________ SCORE ________

**Report on** Hazards and safety practices in a commercial greenhouse or production business

**Condition of the floors:**

Look for slick spots, objects or obstacles in the traffic paths, plant matter on the floor, holes, or dangerous steps

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

**Low-hanging objects:**

______________________________________________________

______________________________________________________

______________________________________________________

Make recommendations for correcting the situation.

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

**Chemical hazards:**

Are chemicals in a separate, locked storage area? Yes No

Are appropriate warning signs in place? Yes No

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

322

**Tool safety:**

Check storage, tools lying about, proper use of tools if people are working.

**Heaters:** Vented? Yes No

**Fans:**

Protected with screens or grates to hands and objects out? Yes No

**Fire extinguishers:**

Locate and describe locations.

Check pressure indicator. Ready to use? Yes No

Are they placed where you can reach them easily and quickly? Yes No

What types?

**First-aid kit:**

Locate and describe location.

Clearly marked? Yes No

Federal safety green? Yes No

**Electrical safety:**

Check visible wiring for breaks and proper ground wire.

**Other hazards:**

________________________________________

________________________________________

________________________________________

**Other safety practices you observe:**

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**ASSIGNMENT SHEET 1**

Check that answers include the categories on the assignment sheet:

**Part I**

Hazards and safety practices in the school greenhouse:

- Condition of the floors and recommendations for correcting the situation
- Chemical hazards
- Tool safety
- Heaters
- Fans
- Fire extinguishers
- First-aid kit
- Electrical safety
- Other hazards
- Other safety practices observed
- Comments and recommendations

**Part II**

Hazards and safety practices in a commercial greenhouse or production business:

- Condition of the floors and recommendations for correcting the situation
- Chemical hazards
- Tool safety
- Heaters
- Fans
- Fire extinguishers
- First-aid kit
- Electrical safety

- Other hazards
- Other safety practices observed
- Comments and recommendations

**OBJECTIVE 17a** **Lift a heavy object correctly.**

**TOOLS AND MATERIALS**

- Heavy object

**PROCEDURE**

1. Step up to object with feet apart; place one foot beside object and one behind. (Figure 1)

FIGURE 1

POTTING MIX
POTTING SOLUTION

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2. Bend at the knees and get a good handhold on the object. (Figure 2)

   NOTE: Your joints and muscles working together give you greater strength than you can achieve by bending over from the back or hips. Always squat to the floor or ground to begin lifting.

3. Tuck chin in. (Figure 2)

   FIGURE 2

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4. Tuck in elbows and arms. (Figure 3)

5. Hold the object close to your body. (Figure 3)

FIGURE 3

6. Keep your back straight and body weight directly over your feet, and push with your legs as you stand straight up. (Figure 4)

FIGURE 4

7. Lift the object into carrying position, **without turning or twisting**, until lift is completed. (Figure 5)

**FIGURE 5**

8. Carry the object ten feet or five paces.

9. Lower the object to the floor by bending at the knees, keeping the back straight, chin and elbows tucked in, object held close to the body—just as you did when you lifted the object. (Figure 6)

10. When the object is securely positioned, release your grip.

**NOTE:** Setting the object down properly is just as important as lifting it correctly. It may seem easier to bend over and let gravity assist in lowering the object. However, gravity can also pull at your joints and back, especially if your weight is not evenly distributed over both feet.

FIGURE 6

**OBJECTIVE 17b**

**Operate a fire extinguisher.**

NOTE: A fire is an emergency that requires the right response in the shortest possible time. You must be so familiar with the fire extinguishers in your building that in an emergency you can operate one immediately, without stopping to "figure it out."

**TOOLS AND MATERIALS**

- Fire extinguisher
- Operating instructions

**PROCEDURE**

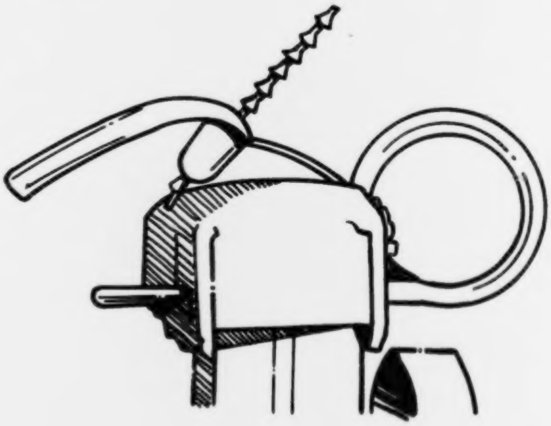
NOTE: If the procedures for the extinguisher in your building are different from these procedures, use the operating instructions written on the extinguisher.

Your instructor may want you to go through the steps without actually pulling the trigger and exhausting all of the chemical, $CO_2$, or water in the tank. In that case, say aloud the step that you are not performing.

EXAMPLE: Instead of actually squeezing the trigger, say, "I squeeze the trigger."

1. Remove extinguisher from wall bracket.
2. Stand 6 to 10 feet away from the fire.
3. Hold extinguisher upright.
4. Pull the pin or release the safety. (Figure 1)

FIGURE 1



5. Squeeze the trigger.

   NOTE: An extinguisher will operate for 1 to 4 minutes, depending on size.

6. Extinguish fire.

   a. **Dry chemical extinguisher**—Sweep side to side and smother the fire with a blanket of chemical.

      **WARNING Do not discharge a dry chemical extinguisher toward a person's face.**

      **CAUTION: Dry chemical must be cleaned up immediately.**

   b. **Water or $CO_2$ extinguisher**—Aim at the base of the fire and sweep side to side

7. Clean up dry chemical and water immediately; clean up fire debris after it has cooled.

8. Report fire to your instructor or supervisor.

   NOTE: The supervisor or instructor will notify the fire department and order the extinguisher refilled.

9. Place a yellow warning tag on the extinguisher.

10. Return extinguisher to wall bracket.

**PRACTICAL TEST 1**

## INTRODUCTION TO SAFETY

# IV

**JOB SHEET 1**

**Lift a heavy object correctly.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Stepped up to object with feet apart; placed one foot beside object and one behind. | _____ | _____ |
| 2. Bent at the knees and had a good handhold on the object. | _____ | _____ |
| 3. Tucked chin in. | _____ | _____ |
| 4. Tucked in elbows and arms. | _____ | _____ |
| 5. Held the object close to the body. | _____ | _____ |
| 6. Kept the back straight and body weight directly over the feet, while pushing with the legs as she/he stood straight up. | _____ | _____ |
| 7. Lifted the object into carrying position, **without turning or twisting**, until lift was completed. | _____ | _____ |
| 8. Carried the object approximately ten feet. | _____ | _____ |
| 9. Lowered the object to the floor by bending at the knees, keeping the back straight, chin and elbows tucked in, object held close to the body. | _____ | _____ |
| 10. Released grip when the object was securely positioned. | _____ | _____ |
| 11. Performed steps in a timely manner. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 12. Provided satisfactory responses to questions asked. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Lifted heavy object | 4 | 3 | 2 | 1 |
| Lowered heavy object | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 2** | **INTRODUCTION TO SAFETY** **IV**

**JOB SHEET 2**

**Operate a fire extinguisher.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Removed extinguisher from wall bracket. | ____ | ____ |
| 2. Stood 6-10 ft. away from the fire. | ____ | ____ |
| 3. Held extinguisher upright. | ____ | ____ |
| 4. Pulled the pin or released the safety. | ____ | ____ |
| 5. Squeezed the trigger (or stated, "I squeeze the trigger."). | ____ | ____ |
| 6. Extinguished the fire with either | ____ | ____ |
| a. Dry chemical extinguisher—Swept side to side and smothered the fire with a blanket of chemical (or stated, "I sweep side to side and smother the fire with a blanket of chemical"). | ____ | ____ |
| OR | | |
| b. Water or $CO_2$ extinguisher—Aimed at the base of the fire and swept side to side (or stated, "I aim at the base of the fire and sweep side to side"). | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 7. Cleaned up dry chemical and water immediately; cleaned up fire debris after it had cooled (or stated, "I clean up dry chemical and water immediately; and clean up the fire debris after it had cooled"). | | |
| 8. Reported the fire to the instructor or supervisor (or stated, "I report the fire to my instructor or supervisor"). | | |
| 9. Placed a yellow warning tag on the extinguisher (or stated, "I place a yellow warning tag on the extinguisher"). | | |
| 10. Returned extinguisher to wall bracket. | | |
| 11. Performed steps in a timely manner. | | |
| 12. Practiced safety rules throughout procedure. | | |
| 13. Provided satisfactory responses to questions asked. | | |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Operated fire extinguisher | | | | |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

# INTRODUCTION TO SAFETY

# IV

**OBJECTIVE 1**

**Match terms associated with safety their correct definitions.** Write the correct letters in the blanks.

___ 1. Poisonous

___ 2. Freedom from danger, risk, or injury

___ 3. Capable of being easily ignited and burning quickly

___ 4. Capable of bursting into flames

___ 5. Any suddenly occurring, unintentional event that causes injury or property damage

___ 6. To put out a fire; to cause to cease burning

___ 7. Source of danger

___ 8. Failure to think before one acts; failure to pay attention

a. Extinguish

b. Toxic

c. Incident

d. Carelessness

e. Combustible

f. Faulty equipment

g. Flammable

h. Accident

i. Hazard

j. Corrosive

k. Distraction

l. Safety

**OBJECTIVE 2**

**State the four major causes of accidents.**

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**OBJECTIVE 3** **State five general job-safety rules.**

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**OBJECTIVE 4** **Describe the purpose of each item of protective clothing listed below.**

Hard-toed, hard-soled shoes— ______________________

______________________________________________

Close-fitting clothing— ___________________________

______________________________________________

Hat— _________________________________________

______________________________________________

Unlined neoprene apron— _________________________

______________________________________________

Unlined neoprene gloves— _________________________

______________________________________________

Unlined neoprene boots— __________________________

______________________________________________

Safety glasses— ________________________________

______________________________________________

Face shield— __________________________________

______________________________________________

Respirators— __________________________________

______________________________________________

Hearing protection—______________________________

______________________________

Spray suit— ______________________________

**OBJECTIVE 5** **Complete statements about dress precautions.** Circle the most correct answer.

1. Clothing and protective gear should be____________.
   a. appropriate for the work to be done
   b. worn in all work situations
   c. worn around moving parts
2. Long hair____________.
   a. should be cut
   b. should be tied back
   c. should be held in a hairnet
3. Gloves____________.
   a. should be worn in most work situations
   b. should be plastic or unlined rubber
   c. should not be worn around moving parts
4. Rings and other jewelry____________.
   a. should be removed before working with power equipment
   b. should not be worn on the jobsite
   c. should be worn in a reasonable amount
5. Tools or sharp objects should not be carried____________.
   a. In an unlocked vehicle
   b. in your pockets
   c. in your hand

**OBJECTIVE 6** **Distinguish among federal safety code colors.**

1. Your instructor is going to light a fussy pilot light on the gas heater. He sends you after the fire extinguisher. What color will you look for?

   ________________________________________

2. The hammers on a chipper/shredder can take off fingers and hands. What color warns you to keep hands away from the hammers?

   ________________________________________

   ________________________________________

3. Yesterday you were using the tiller and hit a large rock, breaking two tines. You brought it back to the shop and tagged it so no one would use it. What are the two colors of tags you could have used?

   ________________________________________

   ________________________________________

4. What color is the stop button on the tiller?________________

5. Two people have tripped on the step between the old greenhouse and the new greenhouse addition. It has to be marked to prevent another accident. What color will you use?______

   ________________________________________

6. Sue knocks over the can of flammable brush cleaner while you are cleaning up from painting the step. You wipe up the spill and look for a place to dispose of the rags. What color container do you look for?________________________

7. You are the newest employee at Standard's Lawn and Landscape Services. Mr. Standard sends you after a 5-gallon can of gasoline to fill the mowers. What color do you look for to locate the area and the can?

   ________________________________________

8. Mr. Standard ordered a pallet of fertilizer delivered at the loading dock. How is the path from the dock to the storage area marked?

   ________________________________________

9. On your second day at Standard's, your co-worker Bob slips on plant matter left on the floor and cuts his arm on a bench. What color are you looking for to locate the first-aid kit?

______________________________

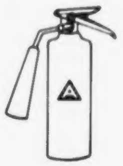
10. The experimental lab at the university is working on a project to improve the gene structure of tomatoes. There is a radiation warning on the door to the lab. What color is it?

______________________________

**OBJECTIVE 7**

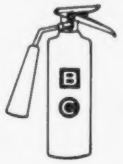
**Determine type of fire extinguisher required to put out specific types of fires.** Write the letter of the correct fire extinguisher beside the following fire descriptions. More than one answer per blank may be required.

___ 1. A 5-gallon can of gasoline spills and ignites from the flame of a propane space heater



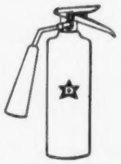
___ 2. Smoke coming from the office computer

___ 3. A trash can full of paper ignited by a cigarette



___ 4. Smoke from the air-conditioner motor

___ 5. An electric hot plate left unattended in an office ignites papers on a bulletin board and spreads to wood paneling



___ 6. Smoke from the fertilizer storage area

**OBJECTIVE 8**

**Select from the list below precautions that should be taken to avoid a lightning strike.** Write an "X" in the blank before each correct statement.

____1. Remain in the car or truck; but do not lean against doors, touch metal parts, or use a CB radio (except for emergencies) during the storm

____2. Crawl under a car

____3. Get away from trees, power poles, and power lines

____4. Find protection in a thick growth of trees or a cave

____5. Move to low ground

____6. Lie on the ground if you are in the open

____7. Stay in the open, away from trees and power poles

____8. Get away from metal tools, fences, or other metal objects

____9. Kneel on the ground if you are in the open

___10. Drop to the kneeling position immediately if you feel your skin tingle or an electric charge that makes your hair stand on end

___11. Stop work when the time between thunder and lightning is less than 5 seconds

___12. Take tools and sit under lower trees or shrubs

**OBJECTIVE 9**

**Match terms associated with electrical safety to their correct definitions.** Write the correct letters in the blanks.

____1. Term used to describe the rate of electrical output

____2. A disruption in the flow of electricity so that only a part or none of the current gets through the circuit

____3. A term used to describe the pressure of electricity

____4. Term used to describe the amount, or strength, of electrical flow through a circuit

a. Voltage

b. Ohm

c. Amp (ampere)

d. Break

e. Watt

f. Circuit

g. Short

h. Current

**OBJECTIVE 10**

**Distinguish between voltage applications.** Write the correct letters in the blanks.

___ 1. Used for small hand tools and equipment such as edgers, trimmers, shears, and small mowers

___ 2. Used to run one-half horsepower and larger motors and electrical heaters

a. 110 v

b. 120 v

c. 240 v

d. 220 v

**OBJECTIVE 11**

**Complete the electrical safety rules listed below.** Write the missing words or phrases in the blanks.

1. Before adjusting or servicing an electrical motor or tool,

   ______________________________________________

2. Always service and use electrical equipment in a __________

3. Always use ____________________________ wiring practices

4. Always use _____________ tools and wear protective clothing when working on wiring, such as: ______________________

   ___________________________________________ and

   ______________________________________________

5. Always have an approved ______________________________ nearby when working with electrical equipment or tools

**OBJECTIVE 12**

**Match electrical protection devices to their correct descriptions.** Write the correct letters in the blanks.

___ 1. A wire or strip of easily melted metal placed in a circuit as a safeguard; when the current becomes too strong, the metal melts, breaking the circuit

___ 2. A device built into an electric motor that automatically interrupts an electric circuit if a short occurs or if the motor overheats

___ 3. Switch-type mechanism that automatically interrupts the flow of electricity when the flow becomes excessive

a. Insulation

b. Short circuit

c. Fuse

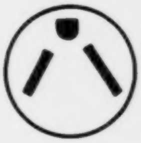
d. Bimetal thermal protector

e. Circuit breaker

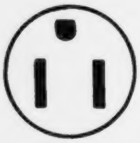
f. Trip switch

**OBJECTIVE 13**

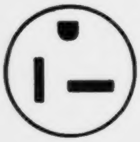
**Label three-wire receptacles.** Write the name of the receptacle in the blank.



1. ____________________



2. ____________________



3. ____________________

**OBJECTIVE 14**

**Complete safety rules for using tools.** Write the missing words or phrases in the blanks.

1. Keep tools ________________ and well ________________
2. Use tools as they are ____________________ to be used
3. Properly ______________ and ________________ all tools
4. Know how to use or operate a tool ____________________ before using it
5. ______________________ and report to the instructor any.

   ____________ tools, machines or equipment
6. Disconnect power equipment from power ________________ before fueling, adjusting, or performing maintenance
7. Keep ____________________ and ____________________ devices in place and in good working condition

**OBJECTIVE 15** State five safety rules for the work area.

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**NOTICE** The following assignment sheet and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 16** **Analyze greenhouse safety.** SCORE ________

**OBJECTIVE 17** **Demonstrate the ability to**

**a. Lift a heavy object correctly.** RATING ______

**b. Operate a fire extinguisher.** RATING ______

**WRITTEN TEST ANSWERS**

## INTRODUCTION TO SAFETY

## IV

**OBJECTIVE 1**

1. b
2. l
3. g
4. e
5. h
6. a
7. i
8. d

**OBJECTIVE 2**

- Carelessness
- Forgetting or disregarding safety practices
- Not knowing how to operate equipment properly
- Improper use of equipment

**OBJECTIVE 3**

- Keep alert and conduct yourself in a safe manner
- Be aware of where others are and what they are doing
- Know the location of fire-fighting and first-aid equipment
- Report all accidents to your instructor, no matter how minor they may seem
- Use proper techniques for lifting a heavy object

**OBJECTIVE 4**

- Hard-toed, hard-soled shoes—Protect feet from dropped objects, cutting edges on equipment and from thrown objects
- Close-fitting clothing—Prevents clothes from getting caught and tangled or pulled by equipment
- Hat—Protects the head from sun and helps prevent heatstroke
- Unlined neoprene apron—Protects skin and clothing when mixing chemicals such as pesticides, herbicides, and fertilizers
- Unlined neoprene gloves—Protect hands when handling chemicals
- Unlined neoprene boots—Protect feet when working with chemicals

- Safety glasses—Protect eyes from thrown and flying objects when working with power tools
- Face shield—Protects eyes and face from flying or thrown objects
- Respirators—Prevents inhalation of pesticides and other toxic chemicals during application
- Hearing protection—Reduces continued noise levels that can damage hearing
- Spray suit—Protects entire body when fogging or spraying highly toxic chemicals

**OBJECTIVE 5**

1. a
2. b
3. c
4. a
5. b

**OBJECTIVE 6**

1. Federal safety red
2. Federal safety orange
3. Federal safety yellow and federal safety blue
4. Federal safety red
5. Federal safety yellow
6. Federal safety yellow
7. Federal safety red
8. Federal safety black and white
9. Federal safety green
10. Federal safety purple (or black on safety yellow)

| | |
|---|---|
| **OBJECTIVE 7** | 1. b, c |
| | 2. b, c |
| | 3. a, b |
| | 4. b, c |
| | 5. b |
| | 6. a, b |
| **OBJECTIVE 8** | 1, 3, 5, 8, 9, 10 |
| **OBJECTIVE 9** | 1. e |
| | 2. g |
| | 3. a |
| | 4. c |
| **OBJECTIVE 10** | 1. b |
| | 2. c |
| **OBJECTIVE 11** | 1. Disconnected |
| | 2. Dry area |
| | 3. Approved |
| | 4. Insulated; insulated rubber boots and gloves and eye protection |
| | 5. Fire extinguisher |
| **OBJECTIVE 12** | 1. c |
| | 2. d |
| | 3. e |

**OBJECTIVE 13**

1. 240 v, 30 amp
2. 120 v, 15 amp
3. 120 v, 20 amp

**OBJECTIVE 14**

1. Sharp, adjusted
2. Intended
3. Maintain, store
4. Properly
5. Tag, defective
6. Source
7. Guards, safety

**OBJECTIVE 15**

Answer may include any six of the following:

- Store materials and supplies safely in their proper places
- Store tools and equipment safely in suitable storage areas
- Keep work areas organized and clear of debris and other hazards
- Clear floors of obstacles and slippery substances; clean up spills immediately
- Keep aisles, exits, and traffic areas free of materials and debris
- Dispose of combustible and hazardous materials properly
- Keep enough brooms, brushes, waste containers, and housekeeping supplies on hand to keep the work area clean

**OBJECTIVE 16**

Refer to answers to Assignment Sheet 1.

**OBJECTIVE 17**

Refer to Practical Tests for Job Sheets 1 and 2.

**OBJECTIVE SHEET**

# GROWING FACILITIES

## V

**INTRODUCTION**

Just as a pianist knows the different types of pianos on sight, or a car enthusiast can recognize models and makes of cars, a greenhouse worker can recognize common greenhouse structures and equipment. Types of growing facilities and related equipment vary widely. As your knowledge and ability grow, you'll learn to notice the different shapes, materials, benches, and systems used in each greenhouse you see or visit.

**UNIT OBJECTIVE**

After completing this unit, the student will be able to discuss growing facilities, their design, and operations. The student will demonstrate these competencies by completing the assignment sheet and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match structural parts of a greenhouse to their descriptions
2. Match types of greenhouses to their descriptions and to their pictures.
3. Select true statements concerning characteristics of materials used for greenhouse frames.
4. Distinguish among characteristics of greenhouse covering materials.
5. Select true statements concerning greenhouse heating, cooling and ventilation systems.
6. Match characteristics of greenhouse benches and beds to their descriptions.
7. Describe greenhouse facilities. (Assignment Sheet 1)

## SUGGESTED ACTIVITIES

## GROWING FACILITIES V

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Select and order teaching materials to supplement unit.
- Provide student with objective sheet.
- Provide student with information sheet.
- Contact local greenhouses and arrange for tours and speakers.
- Contact public relations or advertising department of greenhouse manufacturer and request promotional materials or possibly a guest speaker to discuss types of greenhouses and advanced greenhouse technology.

  NOTE: Supply guest speakers with the Objective Sheet, Information Sheet and any other components you want them to discuss.
- Obtain greenhouse covering materials.

**DELIVERY**

**Objectives 1 and 2**

- Tour a greenhouse, identify and explain structural parts.

**Objectives 3 and 4**

- Show samples of different covering materials to students.
- Discuss advantages and disadvantages of each type of covering.

**Objectives 5 and 6**

- Identify types of benches in the greenhouse your students tour and discuss their characteristics.

## APPLICATION

**Objective 7**

- Use Assignment Sheet 1 to have the students describe the greenhouse they visited.

## EVALUATION

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Media**

- *How to Grow Plants in Greenhouse*. 1/2" VHS, color, 47 min., 1988, Burpee. Designed for a hobby greenhouse, discusses how to design a greenhouse to meet individual needs, how to situate plants in just the right "microclimate," how to custom-mix potting medium, how to select plants that will thrive in the hobby greenhouse, how to avoid common mistakes when watering in a controlled environment, how to feed your plants a healthy diet without over fertilizing, how to control pests and diseases, and how to ensure a healthy, hospitable environment by performing routine seasonal maintenance tasks. Order no. V152. This videotape is available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

- *Greenhouses and Related Structures*. 66 color slides and script, 1982, Ohio Agricultural Education Curriculum Materials Service. Familiarizes students with the various kinds of greenhouse structures and facilities. The slide series is divided into sections: Greenhouses; Uses of Greenhouses; Greenhouse Shapes; Covering materials; Greenhouse Heating, Ventilating and Cooling; and Related Structures. Order No. 2001S (slides and script) or 2002N (script only). Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, OH 43210-1099, telephone (612) 292-4848.

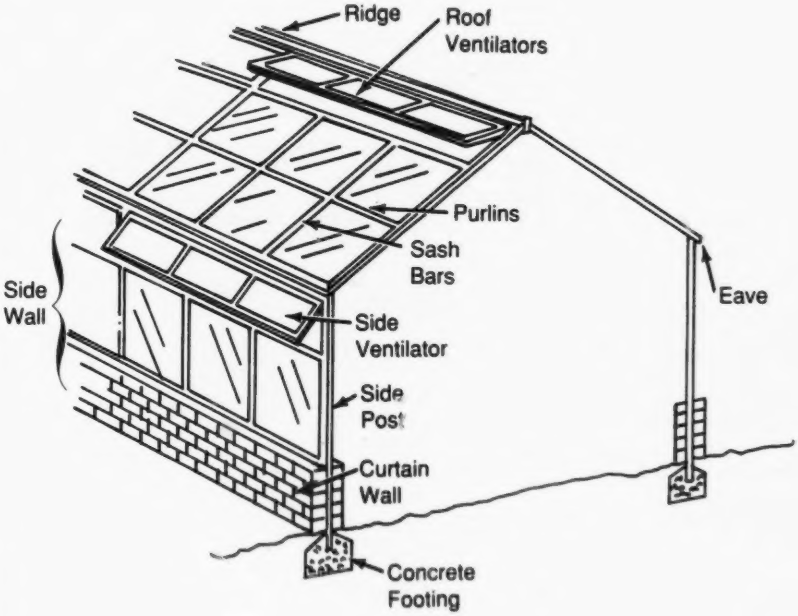
## UNIT REFERENCES

- Geery, Daniel. *Solar Greenhouses: Underground*. Blue Ridge Summit, PA.: Tab Books, Inc., 1980.
- McCullagh, James C. *The Solar Greenhouse Book*. Emmaus, Pa.: Rodale Press, Inc., 1978.
- Nelson, Paul V. Ed. *Greenhouse Operation and Management*. Reston Virginia: Reston Publishing Company, Inc., 1978.
- Reiley, H. Edward and Shry, Carrol. *Introductory Horticulture*, 3rd Ed., Albany, NY: Delmar Publishers, Inc., 1988.
- Richardson, William B. and Moore, Gary E., *Working in Horticulture*, N.Y.: McGraw Hill Co., N.Y., 1980.
- Seddon, George, *The Best Plant Book Ever*, NY: Rand McNally & Co., 1980.

**OBJECTIVE 1**

**Match structural parts of a greenhouse to their descriptions.**

FIGURE 1

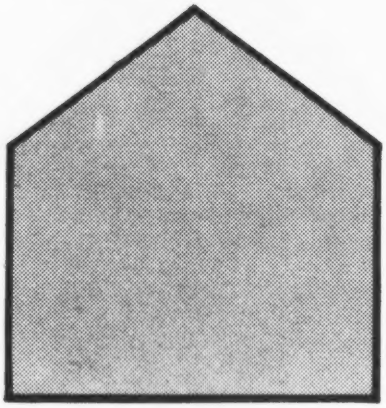

Ridge
Roof Ventilators
Purlins
Sash Bars
Eave
Side Wall
Side Ventilator
Side Post
Curtain Wall
Concrete Footing

- **Sidewall**—Supports the entire weight of the greenhouse and consists of the following component parts: side ventilator, side posts, curtain wall
- **Concrete footer**—Foundation for the side posts; set 3-4 feet below the surface
- **Eave**—Area of greenhouse where top of sidewall joins roof
- **Roof**—Provides a covering over greenhouse and consists of the following parts: sash bars, purlins, roof ventilators, and ridge
- **Sash bar**—Bar made of metal or wood that runs from eave to the ridge and holds the glass in place
- **Purlin**—Bar running length of roof that supports the sash bars
- **Roof and side ventilators**—Allow ventilation during light rain provided there are no strong winds
- **Ridge**—peak of greenhouse
- **Shutters**—operate like windows to allow air flow

**OBJECTIVE 2** **Match types of greenhouses to their descriptions and to their pictures.**

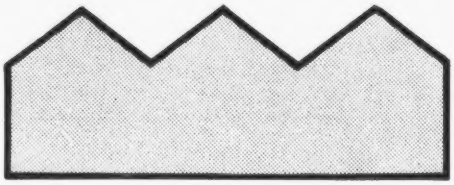
- **Even-span greenhouse**—A self-supporting commercial greenhouse; the distance from the ridge to the eave is equal on both sides

FIGURE 2



- **Ridge-and-furrow greenhouse**—Two or more even-span greenhouses connected at the eaves; contains supports, but no inner walls separating the greenhouses; allows for production of horticulture crops requiring the same growing environments.

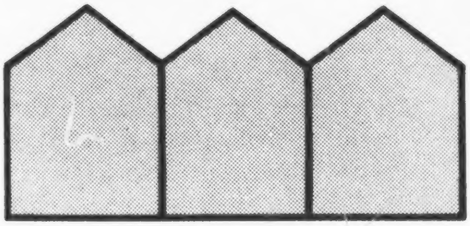
  FIGURE 3

- **Contiguous greenhouse**—Two or more even-span greenhouses connected at the eaves; contains inner walls separating the greenhouses which allows for production of horticulture crops requiring different growing environments.

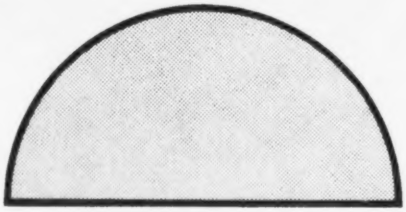
  **NOTE:** Contiguous and ridge-and-furrow greenhouses look similar from outside, but a contiguous greenhouse has inside walls while a ridge-and-furrow greenhouse does not. The walls separate crops that need different environments.

  FIGURE 4

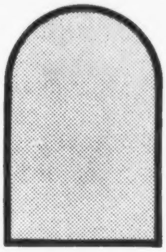
- **Quonset greenhouse**—Looks like an upside down half-circle; frame is made of laminated wood or bent pipe and is covered with polyethylene plastic.

FIGURE 5



- **Quonset with walls**—Similar to quonset but sitting on a raised wall.

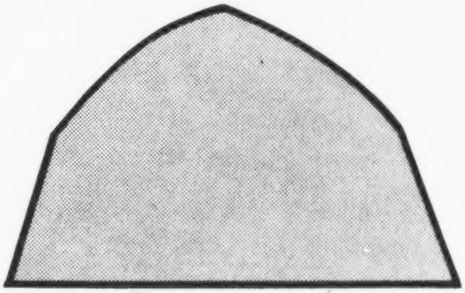
FIGURE 6



- **Gothic greenhouse**—Slightly pointed greenhouse covered with corrugated fiberglass.

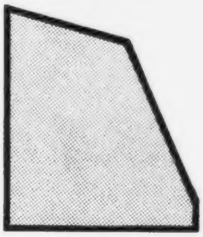
**NOTE:** Gothic style provides greater load bearing strength to handle accumulations of snow.

FIGURE 7



- **Lean-to greenhouse**—Seldom used commercially; attached to the south wall of a self-supporting structure

FIGURE 8



**OBJECTIVE 3**

**Select true statements concerning characteristics of materials used for greenhouse frames.**

- **Wood**—Usually of rot resistant cedar, cypress, or redwood.
- **Aluminum**—Rust and rot resistant
- **Wood-and-steel**—Mostly steel support, with wood for sashes used to hang the glass
- **Pipe**—Usually bent into quonset shape and wrapped with flexible plastic covering

**OBJECTIVE 4**

**Distinguish among characteristics of types of greenhouse coverings.**

(NOTE: All materials listed below can be double layered for additional saving in heating costs.)

- **Glass**—Easily broken, but transmits the most light to plants; most economical for long-term investment
- **Rigid plastics**—Pass less light to the plants than glass; will last 5-25 years, depending on specific material, but will eventually yellow and weaken.
- **Flexible plastics**—Also pass less light to the plants than glass; usually considered temporary; cheapest in the short term, yellow and become brittle, needing replacement in one or two years.
- **Flexible bubble plastic**—Used in packing, this material can cover a greenhouse and provide some insulation.

**OBJECTIVE 5** **Select true statements concerning greenhouse heating, cooling, and ventilation systems.**

- **Hot water heat**—Hot water is circulated through greenhouse in pipes
- **Steam heat**—Steam is circulated through greenhouse in pipes
- **Forced hot air**—Hot air from coal or gas heaters is circulated by a fan through large plastic tubes with side holes. In smaller greenhouses the simple space heater is used.
- **Plant heating**—Heats the plants rather than heating the air; uses electric pads or hot water to heat plant only.
- **Buried heating**—Steam or hot water lines buried below tilling depth in growing beds are sometimes used to provide heat.

  NOTE: Heating the plant and not the air has resulted in tremendous saving in heating fuel.
- **Misting**—Nozzles spray water to provide both humidity and cooling effect.

  NOTE: Plants stop growing when the temperature goes above 90° F. Temperature should be kept at 75°.
- **Fan jet ventilation**—Moves smaller amounts of colder evening or night air through a long perforated tube into all parts of the greenhouse without chilling any one particular area. Can also be used for heating.
- **Fan and wet-fiber pad evaporative cooling**—Fans pull or push air through wet fibrous pad; evaporation of water from the pad cools greenhouse air; most common method of greenhouse cooling.

  NOTE: All other vents are closed while fans are operating. Fans are controlled automatically by thermostats and humidistats.
- **Shutter ventilation system**—Removes gases and maintains proper levels of humidity; provides some cooling also.

**OBJECTIVE 6**

**Match characteristics of greenhouse benches and beds to their descriptions.**

- **Wood and wire mesh bench**—Wood frame covered with 1-inch wire mesh
- **Aisle-eliminating benches**—Moveable bench tops that save space and allow workers to make room as needed.
- **Corrugated asbestos bench**—Hard wavy sheets made of concrete and asbestos.

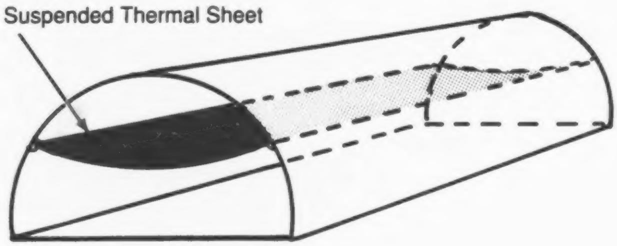
  **CAUTION: Breathing asbestos fibers is dangerous.**
- **Expanded metal bench**—Diamond-shaped mesh pattern; similar to wire mesh but heavier and stronger.
- **Concrete raised benches**—V-shaped; made of reinforced concrete with drainage holes in the bottom
- **Concrete ground bed**—Contains growing medium; used to isolate plants from possibly-contaminated soil beneath concrete.

## THERMAL SHEETS

Heating costs have become a more important factor in greenhouse operation in recent years. Some greenhouse operators have reported significant savings in fuel costs by using thermal sheets. In their simplest form, thermal sheets are sheets of plastic or fiber material strung overhead in a quonset or free-standing greenhouse. The sheets trap warm air and hold it down near the plants, preventing it from rising and heating only the uppermost parts of the greenhouse.

When used as thermal sheets, standard polyethylene plastic can sag and collect condensed water. One solution to this problem is to use woven polyester fabric sheets which allow moisture to escape and dripping water to fall through. Some polyethylene is also manufactured with small perforations which also allows for drainage.

When mounted on tracks or rails, thermal sheets can be moved either manually or automatically. Two layers of material can also be used, one above the other. This approach allows even greater insulation at night. When the lower sheet is removed early in the morning the heat load will increase somewhat and by the time the other sheet is pulled back later in the morning the upper air has already been warmed up to some degree. This method slowly decreases the difference in temperature above and below the thermal sheets and makes it easier for the heating system to keep up with the heat load. Completely removing either a single sheet or two sheets at the same time would result in the warm air rushing up and suddenly forcing the cold air down onto the plants, causing shock.



**ASSIGNMENT SHEET 1**

## GROWING FACILITIES

**V**

NAME ______________________________ SCORE _______

**OBJECTIVE 7**

**Describe greenhouse facilities.**

**INTRODUCTION**

Greenhouses are built from many of the same basic designs, using common materials for construction. Choices for benches, bedding material, and heating, cooling, and irrigation systems are much the same throughout the industry. However, each greenhouse will have a different combination of characteristics. As a greenhouse employee, you should be aware of types of construction and the effect different materials and arrangements will have on the plants.

**DIRECTIONS**

1. Observe the greenhouse you visit carefully.
2. Ask questions of the owner or operator.
3. Take notes.
4. Write a description of the greenhouse. Use information from the information sheet. Describe the following:
   a. Greenhouse shape

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

   b. Greenhouse frame

   ______________________________________________

   ______________________________________________

   ______________________________________________

   ______________________________________________

c. Greenhouse covering

d. Ventilation system

e. Benches or bedding used

f. Heating system

g. Cooling system

## GROWING FACILITIES

**ASSIGNMENT SHEET 1**

Answers will vary according to the type of greenhouse visited. Refer to Information Sheet. Check that answer includes:

a. Greenhouse shape

b. Greenhouse frame

c. Greenhouse covering

d. Ventilation system

e. Benches or bedding used

f. Heating system

g. Cooling system

**WRITTEN TEST**

## GROWING FACILITIES

## V

NAME ______________________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with structural parts of greenhouses to their descriptions.** Write the letter in the space before the definition.

___ 1. Provides a covering over greenhouse and consists of the following parts: sash bars, purlins, roof ventilators, and ridge

___ 2. Foundation for the side posts; set 3-4 feet below the surface

___ 3. Area of greenhouse where top of sidewall joins roof

___ 4. Supports the entire weight of the greenhouse and consists of the following component parts: side ventilator, side posts, curtain wall

___ 5. Operate like windows to allow air flow

___ 6. Allows ventilation during light rain provided there are no strong winds

___ 7. Peak of greenhouse

___ 8. Bar made of metal or wood that runs from eave to the ridge and holds the glass in place

___ 9. Bar running length of roof that supports the sash bars

a. Ridge-and-furrow

b. Spaghetti system

c. Ridge

d. Sash bar

e. Eave

f. Sidewall

g. Concrete footer

h. Roof

i. Cold frame

j. Headhouse

k. Roof and side ventilators

l. Purlin

m. Shutters

**OBJECTIVE 2** **Match types of greenhouses to their descriptions and to their pictures.**

**PART I** Write the correct letter in the blanks.

____1. Greenhouse that is seldom used commercially; attached to the south side of a self-supporting structure

____2. Two or more even-span greenhouses connected together at the eaves; contains no inner walls separating the greenhouses which allows for production of crops requiring the same growing environments

____3. Two or more even-span greenhouses connected together at the eaves; contains inner walls separating the greenhouses which allows for production of crops requiring different growing environments

____4. A self-supporting commercial greenhouse; the distance from the ridge to the eave is equal on both sides

____5. Looks like an upside down half-circle; frame is made of laminated wood or bent pipe covered with polyethylene plastic

____6. Slightly pointed greenhouse covered with corrugated fiberglass

a. Sidewall

b. Quonset greenhouse

c. Contiguous greenhouse

d. Even-span greenhouse

e. Lathouse

f. Hotbed

g. Lean-to greenhouse

h. Gothic

i. Shade house

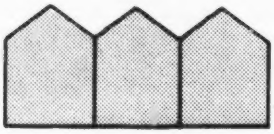
j. Ridge-and-furrow

k. Wintering house

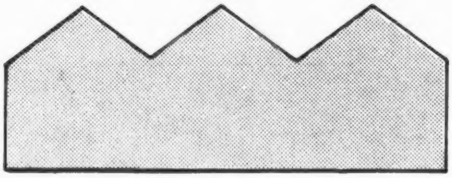
l. Cold frame

**PART II** Write the name of the type of greenhouse under the picture.

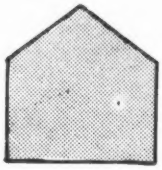
Hotbed
Lean-to greenhouse
Gothic
Sidewall
Quonset greenhouse
Contiguous greenhouse
Even-span greenhouse
Lathouse
Shade house
Ridge-and-furrow
Wintering house
Cold frame



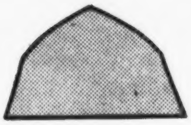
a. ____________________



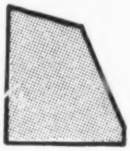
b. ____________________



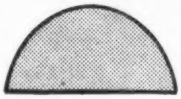
c. ____________________



d. ______________________



e. ______________________



f. ______________________

**OBJECTIVE 3** **Select true statements concerning characteristics of materials used for greenhouse frames.** Circle the "T" or "F".

1. T or F Wood-and-steel—Mostly steel support, with wood for sashes used to hang the glass

2. T or F PVC Pipe—Used with glass attached at sides

3. T or F Wood—Usually of rot resistant cedar, cypress, or redwood.

4. T or F Aluminum—Rust and rot resistant

5. T or F Copper or brass frames—Used to connect contiguous greenhouses

6. T or F Alnico—Used because it resists corrosion

7. T or F Wood-and-fiberglass—usually has purloin of pine

8. T or F Fiberglass—Used for growing plants with acid medium.

9. T or F Pipe—Usually bent into quonset shape and wrapped with flexible plastic covering

10. T or F Aluminum—Used for its high heat transmissibility

**OBJECTIVE 4** **Distinguish among characteristics of greenhouse covering materials.** Write "G" for characteristics of glass. Write "RP" for characteristics of Rigid Plastic. Write "FP" for characteristics of Flexible Plastic. Write "FB" for Flexible Bubble Plastic. Some items require more than one answer. one answer.

___ 1. Eventually yellows and weakens

___ 2. Easily broken

___ 3. Lasts 5-25 years

___ 4. Most economical for long-term investment

___ 5. Passes less light to the plants than glass

___ 6. Cheapest in the short term

___ 7. Becomes yellow and brittle in one or two years

___ 8. Can cover a greenhouse and provide some insulation

___ 9. Transmits the most light to plants

___ 10. Usually considered temporary

**OBJECTIVE 5**

**Select true statements concerning greenhouse heating, cooling, and ventilation systems.** Write "T" or "F" in the blanks.

____1. Steam pipes heat the soil while killing bacteria

____2. Hot air from coal or gas heaters is circulated by a fan through large plastic tubes with side holes

____3. Hot water is circulated through greenhouse in pipes

____4. Steam is circulated through greenhouse in pipes

____5. Steam is sprayed into the air

____6. Overhead fans cool by exhausting out hot air

____7. The simple space heater is used in smaller greenhouses

____8. Plant heating—Rather than heating the air, uses electric pads or hot water to heat plant only

____9. Fan and wet-fiber pad—Fans pull or push air through wet fibrous pad; evaporation of water from the pad cools greenhouse air; most common method for cooling greenhouses

___10. Freon air conditioners are commonly used for cooling greenhouses

___11. Steam heat removes gases and maintains proper levels of humidity

___12. Fan jet ventilation moves small amounts of cold evening or night air through a tube to cool all parts of the greenhouse without chilling any one area

___13. A shutter ventilation system sprays water to provide both humidity and cooling effect

___14. Misting heats and humidifies

___15. Fan and wet-fiber pads cool by evaporation

**OBJECTIVE 6**

**Match characteristics of greenhouse benches and beds to their descriptions.** Write the correct letter in the space before the definition.

___ 1. Wood frame covered with 1 inch wire mesh

___ 2. Hard wavy sheets made of concrete and asbestos

___ 3. Diamond-shaped pattern, is similar to wire mesh but heavier and stronger

___ 4. Use moveable bench tops to save space and allow workers to make room as needed

___ 5. V-shaped benches made of reinforced concrete with drainage holes in the bottom

___ 6. Contains growing medium but is used to isolate the plant from possibly contaminated soil beneath concrete

a. Corrugated asbestos bench

b. Aisle eliminating benches

c. Wood and wire mesh bench

b. Stainless steel bench

e. Slab bench

f. Expanded metal bench

g. Cellular bench

h. Mobile bench

i Concrete ground bed

j. Portland bench

k. Concrete raised benches

**NOTICE**

In addition to the written test items, the student will be required to demonstrate mastery of the following objective.

**OBJECTIVE 7**

**Describe greenhouse facilities.** SCORE ________

## WRITTEN TEST ANSWERS | GROWING FACILITIES | V

**OBJECTIVE 1**

1. h
2. g
3. e
4. f
5. m
6. k
7. c
8. d
9. l

**OBJECTIVE 2**

**PART I**

1. g
2. j
3. c
4. d
5. b
6. h

**PART II**

a. Contiguous
b. Ridge & furrow
c. Even-span
d. Gothic
e. Lean-to
f. Quonset

**OBJECTIVE 3**

1. T
2. F
3. T
4. T
5. F
6. F
7. F
8. F
9. T
10. F

**OBJECTIVE 4**

1. RP
2. G
3. RP
4. G
5. RP OR FP
6. FP
7. FP
8. FB
9. G
10. FP

**OBJECTIVE 5**

1. F
2. T
3. T
4. T
5. F
6. F
7. T
8. T
9. T
10. F
11. F
12. T
13. F
14. F
15. T

**OBJECTIVE 6**

1. c
2. a
3. f
4. b
5. k
6. i

**OBJECTIVE 7**

Refer to answers to Assignment Sheet 1.

**OBJECTIVE SHEET**

# GREENHOUSE WATERING

# VI

## INTRODUCTION

Greenhouse watering systems provide plants the correct amount of water on a regular basis needed for their growth. There are several methods of applying water and a variety of equipment available. Water drainage, frequency, amount, quality, and temperature are important factors to growing vigorous plant crops. Watering systems can also add nutrients to the soil to further plant growth. There are several methods used to calculate the amount of water and fertilizers plants need.

## UNIT OBJECTIVE

After completing this unit, the student should demonstrate knowledge of the role of water in plant growth and environmental factors affecting greenhouse watering. The student should be able to describe watering methods and types of systems, including hand-watering. Students should use that knowledge to use a greenhouse watering system by determining correct water frequency, quantity, quality, temperature, humidity levels, and proper ventilation. The student will demonstrate these competencies by completing assignments sheets, job sheets, and written test with a minimum of 85 percent accuracy.

## SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with greenhouse watering to their correct definitions.
2. Select true statements about environmental factors that affect watering.
3. Distinguish among manual, automatic, and foliage watering systems.
4. Match types of watering equipment to their descriptions.
5. Select true statements about types of irrigation fertilizing equipment.
6. Select true statements about proper drainage and salt build-up.
7. Complete statements about determining water quantity.
8. State indicators used to determine the watering needs of plants.

9. Select true statements about water quality and temperature.

10. List the advantages and disadvantages of hand watering.

11. Select true statements about the proper procedure for using a greenhouse watering system to feed plants.

12. Select true statements about proper humidity and ventilation.

13. Describe the correct watering method for propagating plants. (Assignment Sheet 1)

14. Determine the watering needs of plants. (Assignment Sheet 2)

15. Calculate the water quantity for bench plants using an automatic watering system. (Assignment Sheet 3)

16. Calculate the amount of fertilizer for a proportioning pump in an automatic watering system and a hand-held hozon. (Assignment Sheet 4)

17. Create a line drawing of a design for an automatic watering system, label all parts, and prescribe system maintenance. (Assignment Sheet 5)

18. Demonstrate the ability to:

    a. Water by hand. (Job Sheet 1)

    b. Check moisture levels. (Job Sheet 2)

    c. Determine watering frequency. (Job Sheet 3)

    d. Check water temperature, water by hand, and leach soil. (Job Sheet 4)

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine time schedule for students to demonstrate competence in the required procedures.
- Divide the objectives, assignment sheets, handouts, and tests into two or three sections to deliver and test separately.
- Order materials to supplement unit.
- Supplier's Catalogues—Usually available at no charge, these catalogues provide equipment descriptions, illustrations, and, in some cases, guidelines for selecting equipment.
- Gather horticulture and gardening magazines, books, catalogues, and other resources to learn the water requirements of a wide variety of plants. Look for irrigated gardens that contain plants with different moisture requirements to use as examples.
- Have a moisture meter available to demonstrate its use to students.
- Arrange a field trip for students to see a commercial greenhouse or successful home gardening watering operation.

  **NOTE:** Greenhouse operators or grounds managers at major public institutions, such as universities or government offices, are an excellent resource. (Supply all guest speakers with Objective Sheet, Information Sheet, and any other unit components you want them to cover).
- Invite a commercial greenhouse operator or successful home gardener to discuss water methods.
- Invite a landscape architect or commercial irrigation company representative to discuss irrigation planning.

**NOTE:** Supply all guest speakers with objective sheets, information sheets, and any other components you want them to cover.

## DELIVERY

**Objectives 1 and 2**

- Review the role of water in photosynthesis. Discuss how water contributes to plant growth.
- Show students samples of different types of pots and growing media available.

**Objectives 3 through 8**

- Teach memorization techniques to help students learn and memorize watering methods, equipment, and indicators of under/overwatering.
- Bring in a plant that is suffering from overwatering and one distressed from underwatering. Have students identify what is wrong and what needs to be corrected with the watering methods of each plant.
- Stress that every horticulture student should know the two types of watering methods (manual and automatic), six types of watering equipment, two types of irrigation fertilizing equipment, and seven signs each of underwatering and overwatering. These are minimum requirements.
- Go to a greenhouse and identify watering problems, methods, and systems in use. Use a humidity measurer to make a humidity reading. Observe acceptable humidity levels for seed germination and plant growth for study in Objective 7.
- Discuss the different types of watering systems. Suggest and assist students with compiling a chart identifying the types of watering devices, usages, advantages, and disadvantages of each.
- Discuss Supplement 3, "Designs of Two Common Greenhouse Irrigation Systems and Maintenance Requirements."

**Objectives 9 through 12**

- Discuss Supplement 1 "Satisfactory Water Analysis Report," Supplement 2 "Unsatisfactory Water Analysis Report," (and Job Sheet 4 to supplement Objective 9).
- Discuss Supplement 3.

- Lead a discussion by asking students, "How does humidity affect plant growth? Should a greenhouse be humid? What is an acceptable humidity reading?"
- Review the importance of nutrients to plant growth.
- Lead a discussion on economical ways to achieve 100% relative humidity to create an ideal plant growth environment.

**APPLICATION**

**Objectives 13 through 18**

- Use Assignment Sheet 1 to give students practice and experience in describing the correct watering method for propagating greenhouse plants.
- Use Assignment Sheet 2 to give students practice and experience determining seven indicators to water more and less frequently.
- Use Assignment Sheet 3 to give students practice and experience calculating the water quantity needed to water a bench using an automatic watering system.
- Use Assignment Sheet 4 to give students practice and experience calculating the amount of fertilizer for a proportioning pump in an automatic watering system and a hand-held hozon.
- Use Assignment Sheet 5 to give students practice and experience creating a line drawing of a design for an automatic watering system, labeling all parts, and prescribing system maintenance.
- If possible, carry a single group of students through the entire process of Job Sheets 1 through 4. If maintaining continuity is not possible, allow students present to continue the projects.
- Refer students to Unit 7 *Plant Growth and Responses* to learn more about how plants respond to water. Refer students to Unit 13 *Introduction to Fertilizers* to learn about fertilizer types and selections.

## EVALUATION

**Practical test**

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used for the practical test.
- Reteach and retest as necessary.

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections, if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *How to Grow Plants in a Greenhouse*. 1/2" VHS, color, 47 min., Kartes Video Productions. Covers eight areas of growing plants in a greenhouse: design options, greenhouse evaluation, planting medium, growing greenhouse plants, watering techniques, feeding greenhouse plants, pest/disease control, and the annual greenhouse cycle. Order No. 251 X. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210-1099, telephone (614) 292-4848.

## UNIT REFERENCES

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- Nelson, Kennard S., *Flower and Plant Production*, 2nd edition. Danville, Illinois: Interstate Printers & Publishers, 1980.
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## INFORMATION SHEET

## GREENHOUSE WATERING

## VI

**OBJECTIVE 1**

**Match terms associated with greenhouse watering to their correct definitions.**

- **Transpiration**—Evaporation process in which a plant looses moisture through small openings in the leaves
- **Ventilation**—Air movement in a greenhouse
- **Tepid water**—Moderately warm water at 72 degrees
- **Bench-grown plants**—Plants grown in a raised bed in a controlled environment

  NOTE: These plants are planted in soil mixtures in containers. Bench-grown plants are not grown directly in native soil.

- **Turgidity**—Swelling of plant material that is the result of water stored in a plant

  NOTE: Water is a major element that makes up a plant body. Watering frequency and amount affect the level of turgidity.

- **Capillary action**—The upward movement of fluids through the soil and plant parts
- **Capillary pores**—Solid spaces containing soil or water
- **Noncapillary pores**—Small voids or open spaces in soil that are filled with air and allow capillary action
- **Semipermeable**—Able to partially penetrate or seep through
- **Osmosis**—The diffusion process of fluids through a semipermeable membrane until an equal amount of fluid exists on either side of the membrane
- **Soluble salts**—Any of the various mineral salts that are water soluble (can be dissolved in water)
- **Leaching**—Process to remove soluble salts from the soil by water action
- **Chlorine**—A chemical added to water systems as a disinfectant to increase sanitation by killing germs

- **Fluoride**—A chemical frequently added to water systems to increase the body's resistance to tooth decay

**OBJECTIVE 2**

**Select true statements about environmental factors that affect watering.**

- **Container**—Plants grown in containers usually require more water than bench-grown plants.

  EXAMPLES: Clay, ceramic, or plastic pots are container materials

  **NOTE:** Unpainted clay pots require more water than glazed ceramic or plastic pots. The porous clay allows water from the soil to be carried by osmosis to the outer surface of the pot where it evaporates. Potted plants are more likely to be properly spaced than bench plants in a greenhouse. This reduces plant loss or shrinkage.

- **Relative humidity**—Relative humidity is the amount of moisture in the air compared to the maximum amount of moisture the air can hold. Low relative humidity environments cause plants to draw moisture from the soil and increase soil dryness.

- **Temperature**—Higher temperatures and lower relative humidity speed moisture evaporation from plant leaf, soil, and containers. More frequent watering is required to maintain ideal growing conditions in this environment.

- **Climate**—A fair day requires more water than a cloudy day.

- **Media**—Nonporous clay and sandy soils require more regular soils or soil mixes containing organic matter, peat moss, or vermiculite. Peat will hold up to 15 times its weight in water, making it an important ingredient in soil mixtures.

- The ideal growing media is a mixture of 50% soil, 25% capillary pores (water), and 25% noncapillary pores (air). This ratio is generally required for good root and leaf growth.

- Air in the soil provides space that allows the movement of water and nutrients by capillary action. For this reason, plants should not remain in waterlogged soil. The excess water reduces the amount of oxygen in the soil and damages the roots.

- **Rainfall**—Rainfall is a critical factor to nursery-grown plants or plants placed outside. The frequency and amount of rainfall affects watering frequency and amounts. It also influences the pH balance of soils.

  Heavy rainfalls leach away certain soluble salts. This sometimes causes acidity in the surface soil. In areas of low rainfall, soluble salts remain in the surface soil. This causes the topsoil to become more alkaline.

**OBJECTIVE 3**

**Distinguish among manual, automatic, and foliage watering systems.**

- **Manual watering**—A hand-performed watering method best suited for cut flowers or pot plants that do not require daily watering
- **Automatic watering system**—An electronically-activated watering system that is best suited for large areas or plants that require daily or more frequent watering

  NOTE: Automatic and semi-automatic watering systems water plants from above. Trays placed under plants and capillary watering apply water from below.
- **Water applied from above (foliage watering)**—Foliage should be watered early in the day and not in the evening. Watering early in the day allows water to evaporate from wet foliage. Wet foliage in cool, damp environments promote fungus growth and disease

  The water stream from overhead, such as the mist and flat nozzle systems, can wash off the insects and aid in insect control
- **Water applied from below**—Systems such as capillary mats and perimeter systems have the advantage of not wetting foliage

**OBJECTIVE 4**

**Match types of watering equipment to their descriptions.**

- **Water breaker**—A manual-system watering device used to apply a large volume of water without compacting or washing the soil

FIGURE 1 (Water breaker)

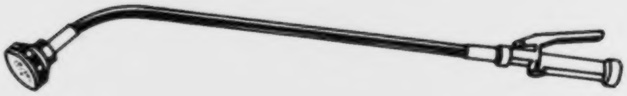


Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Spaghetti system**—An automatic method consisting of a system of tubes placed into each plant pot

FIGURE 2

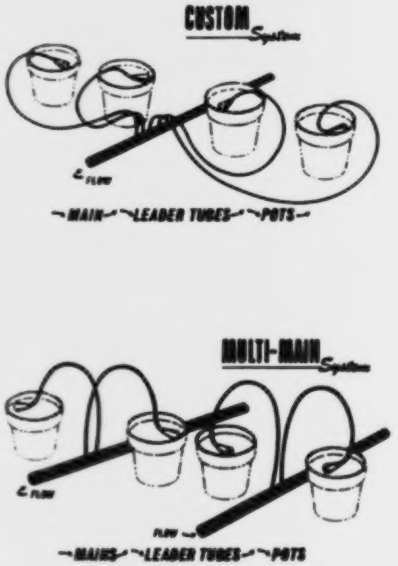
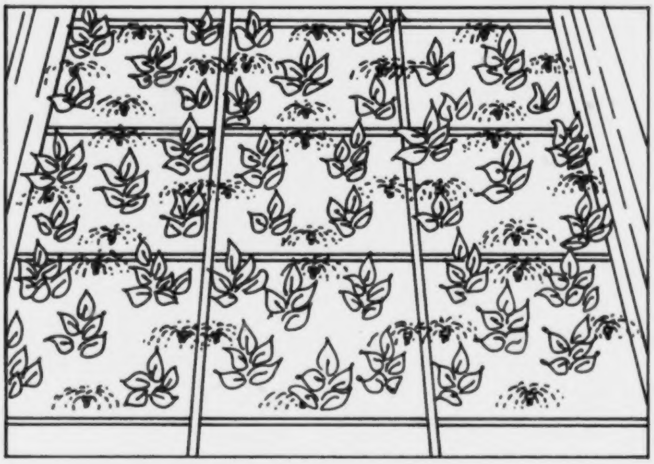

CUSTOM System
← FLOW
MAIN LEADER TUBES POTS
MULTI-MAIN System
← FLOW
FLOW →
MAINS LEADER TUBES POTS

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

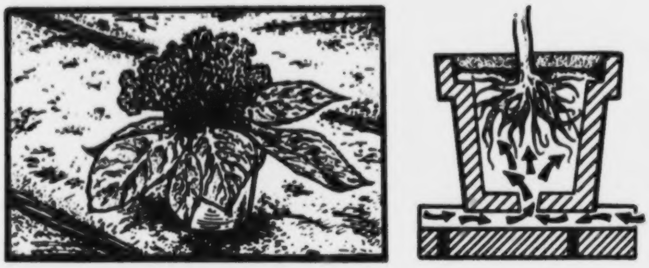
- **Perimeter watering**—Plastic pipe with nozzles is placed around the outside of a plot. The nozzles spray water over the growing medium and below the foliage

FIGURE 3



- **Capillary watering mats**—Plants are placed on synthetic fibrous material soaked with water. Plant capillary action draws the water upward. An advantage of this system is that it provides adequate moisture for potted plants of mixed sizes housed in a bench

FIGURE 4



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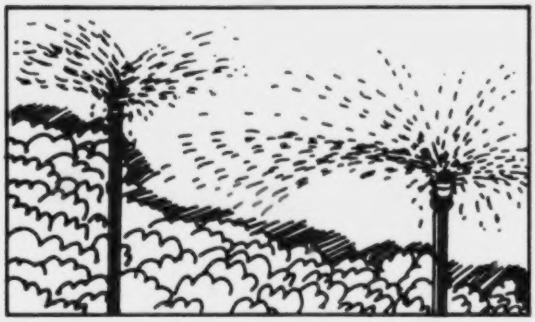
- **Flat spray nozzle system**—An automatic method consisting of a system of nozzles that emit a flat water spray. This system is generally used to water cut flower crops. It applies adequate water to moisten all the soil. Water should drain from pots or benches. One control valve can water from one to six benches

  EXAMPLES: Carnations, chrysanthemums, roses, and snapdragons

  FIGURE 5



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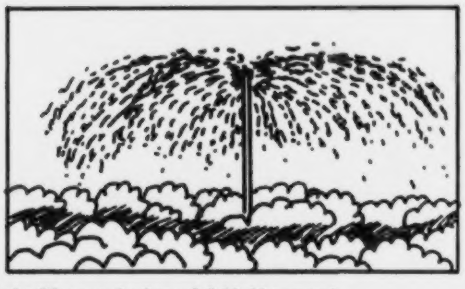
- **Mist system**—An automatic method consisting of a series of nozzles mounted on standpipes. Nozzles emit a fine water mist in a six-foot circular pattern that sprays over the plants. Nozzles are mounted at four-foot intervals down the center of a bench

  The mist system is used to germinate seeds and propagate cuttings. It applies adequate water to moisten all the soil. Water should drain from pots or benches.

  EXAMPLES: Moss rose, petunia, sunflower, and other seeds. Begonias, English ivy, golden pathos, and other cuttings for propagation.

  FIGURE 6



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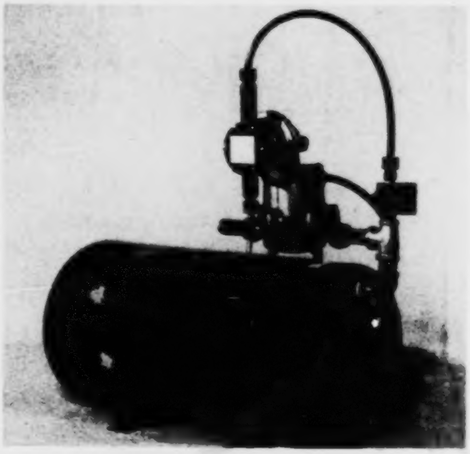
**OBJECTIVE 5**

**Select true statements about types of irrigation fertilizing equipment.**

- **Proportioning pump (injector system)**—Used in large greenhouses to distribute a variable amount of soluble nutrients to feed plants as they are watered

FIGURE 7



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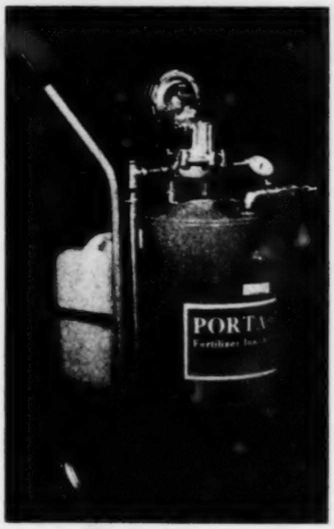
a. Stationary proportioning pump



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b. Portable unit used in smaller greenhouses and for applying nutrients to single crops or benches

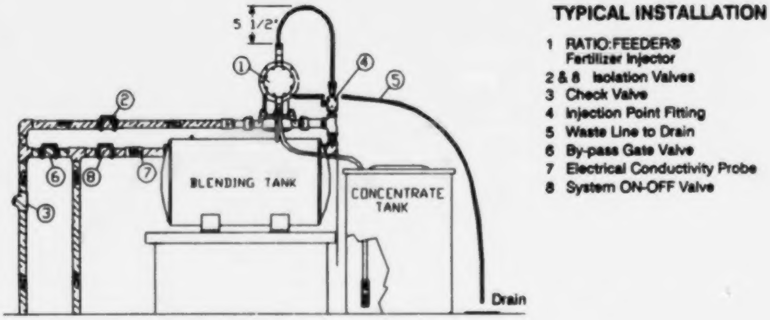
TYPICAL INSTALLATION
1 RATIO:FEEDER® Fertilizer Injector
2 & 8 Isolation Valves
3 Check Valve
4 Injection Point Fitting
5 Waste Line to Drain
6 By-pass Gate Valve
7 Electrical Conductivity Probe
8 System ON-OFF Valve
5 1/2"
①
②
③
④
⑤
⑥
⑦
⑧
BLENDING TANK
CONCENTRATE TANK
Drain

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

c. Parts of a proportional pump

- **Hozon**—An inexpensive hand-held device used to apply soluble fertilizer to a small number of plants

FIGURE 8

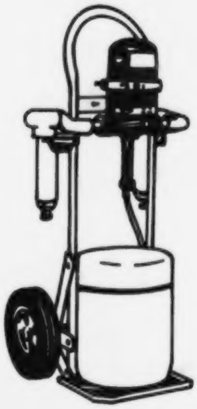

Illustration courtesy of H.E. Anderson Company, Muskogee, OK

- **Sensing device**—A monitor that detects such environmental factors as rainfall, sunlight, and temperature to coordinate water requirements
- **Timeclock**—A device that automatically activates and deactivates a watering system according to preset sequences

**OBJECTIVE 6**

**Select true statements about proper drainage and salt build-up.**

NOTE: Good drainage prevents waterlogged growing media. Adequate numbers and sizes of holes in the bottoms of containers provide enough drainage. When pots without drainage holes are used, one to two inches of coarse gravel or vermiculite should be placed in the bottom of the container.

- Proper drainage:
  - a. Allows water to flow freely from the pot
  - b. Thoroughly moistens the entire soil ball
  - c. Leaches the soil of excessive fertilizers and nonfertilizer elements that might build-up and become toxic to plants
  - d. Leaches soluble minerals from the soil to prevent excessive salt build-up
- Water contains salt and other hard minerals that may be damaging to plants. Salt build-up can occur with plants whether water is applied from above or below foliage.
- When watering from above (as in mist systems), salt build-up occurs at the bottom of the container in plants given inadequate amounts of water to thoroughly flush the soil.
- When watering from below (as in capillary mats), salt build-up occurs at the top of the soil where salts are deposited.
- The first sign of salt build-up is browning on the tips of leaves. Frequently, salty, white crystalline material will appear at the top of the soil and around the container.
- To remove salt build-up, leach the soil by watering well-drained pots with a spray of water for several minutes or until the water drains from the container in a steady, free-flowing stream.

**OBJECTIVE 7**

**Complete statements about determining water quantity.**

- Greenhouse watering regulates the amount of water and air in the soil.
- Water quantity depends on soil mix, plant size, pot size, humidity, and temperature.

- In benches or raised beds, apply 1/15 of a gallon of water per square foot for each inch of depth.

- Ten percent of the water applied to a pot or bench should exit from the bottom of a well-drained container.

- Do not overwater or let plants stand in waterlogged media. Excess water reduces the amount of oxygen in the soil and damages the root system. Plants develop damaged roots or "wet feet," which prevent the plant from absorbing water and nutrients to promote strong, vigorous growth.

- New growth in overwatered plants may appear soft and wilt under bright light or dry conditions. The flowers wither. The leaves turn yellow and perhaps drop.

- Do not let plants wilt from lack of water. This retards photosynthesis and slows growth.

- Underwatered plants can appear hardened with smaller plant leaves and shorter lengths of stems between leaves (internodes). In some cases, leaves may appear burned or drop off.

- Do not guess when to water plants. Check a sample by knocking the root ball from the pot.

- Withhold water if water can be squeezed from the root ball or if water rests in the bottom of the container.

- Increase water frequency and amount if soil is dry and warm to touch.

**OBJECTIVE 8** **State indicators used to determine the watering needs of plants.**

- **Water more frequently if:**
  - A container is unglazed clay
  - A container is completely filled with roots
  - A large plant is in a small container
  - The soil pulls away from the sides of the pot
  - It is sunny and windy
  - A plant has wide, thin leaves
  - Stems are thin or woody

- A plant is a tree fern or grown on a slab of bark
- A plant has blooms and much foliage
- A plant is in active growth with good light

- **Water less frequently if:**
  - A plant has few roots in a large pot
  - A small plant is in a large pot
  - Humidity is high or it is raining
  - It is cloudy and the air is still
  - Weather is cool (below 65 degrees)
  - Growth is succulent as in agaves, aloes, and cacti
  - A plant has sparse foliage
  - A plant is just getting established
  - The bulb has just been planted
  - A plant is resting or dormant
  - A container is plastic, glazed or painted

**OBJECTIVE 9**

**Select true statements about water quality and temperature.** (Supplements 1 and 2)

- Water quality is important for greenhouse watering. Water quality, mineral content, additives, and foreign matter varies with geography and water source.
- Chlorine and fluorine added to city water systems are usually not present in high enough quantities to damage greenhouse plants.

  **NOTE:** One ppm (parts per million) fluorine added to water systems is harmful to some plants, such as *Cordyline terminalis Kunth*, Baby Doll. It is best to avoid fluoridated water in these cases.
- Water softeners added to some water systems can add sufficient sodium to be harmful to greenhouse plants.
- Test the chemical content of water for total soluble salt reading before using it in the greenhouse.

NOTE: An independent water tester, health department, or county agent can recommend procedures to test water samples.

- Excessive levels of sodium and boron in ground water are common in the southwestern region of the country.
- Injurious levels of sodium bicarbonate or sodium chloride may occur in coastal areas where seawater may infiltrate ground water.

  NOTE: When high levels of salt are present, the growing medium must never become excessively dry. This concentrates the salts in the soil and magnifies the problem.

- Consider the total soluble salt reading and make adjustments for these in your fertilizer program.
- Use litmus paper or a swimming pool testing kit to check the acidity and alkalinity of water. The health department or an independent water tester can recommend more accurate tests.
- Strong alkaline water can adversely affect plants that require acidic growing conditions.

  EXAMPLES: Azaleas, conifers, gardenias, and hydrangeas

- Use tepid water (72 degrees) to avoid root shock.

  NOTE: Ground water temperature varies with location, season, and source. Temperatures range from freezing to steaming. Test the temperature before applying water to plants.

**OBJECTIVE 10** **List the advantages and disadvantages of hand watering.**

- **Advantages of hand watering are that it allows an experienced operator to:**
  - Grow plants in different size and types of pots on the same bench
  - Determine which plants need water
  - Inspect plants for signs of disease and stress
  - Spot water select pots or areas that dried sooner than others

- **Disadvantages of hand watering are:**
  - It is a hidden labor cost that makes it more expensive than automatic watering
  - It is difficult to gauge amounts

OBJECTIVE 11

**Select true statements about the proper procedure for using a greenhouse watering system to feed plants.** (Supplement 3)

- Liquid feeding of prepared commercial mixtures and individual nutrients are now the most common methods of feeding greenhouse plants. Consistent light applications of liquid fertilizer during active growth periods appears to produce higher quality plants than heavier applications at longer intervals. Insecticides and fungicides are other mixtures that can be added to the watering system. Labor is saved by using liquid mixtures and fertilizers to feed bench crops. Water soil thoroughly so excess water and additives drain from the container or bench.

  NOTE: Follow the manufacturer's instructions for liquid feeding.

**Proportioning Pumps**

- Commercial greenhouses use proportioning pumps to apply liquid nutrients. The pumps operate on water pressure and do not require other power sources.

  Pumps can be set to distribute the desired amount of liquid or soluble nutrients. Typical proportioning pumps inject fertilizer concentrate into the water stream in a proportion of one part fertilizer to 100 parts water. This is a 1:100 ratio.

  Pumps are available in different sizes; some deliver up to 100 gallons per minute.

**Hozon Nozzles**

- Inexpensive, hand-held hozons are used to apply soluble nutrients to a small number of plants.

  Standard hozon nozzles are calibrated to use one gallon of fertilizer for every 15 gallons of water. This is a 1:15 ratio.

**OBJECTIVE 12**

**Select true statements about proper humidity and ventilation.**

- Seeds require 100% relative humidity to germinate.
- A humidity level of 75% is satisfactory for most greenhouses.
- Humidity is measured with a humidity meter or gauge.
- Ventilation supplies oxygen required by plants and assists in removing gases and controlling plant disease.
- Minute amounts of natural gas and trace particles of ethylene gas can seriously harm some plants and ruin blooms. Ethylene is found in manufactured gas. It is emitted from decaying vegetable matter and very ripe fruit, particularly apples and pears. Gas greenhouse heating sources, natural gas lines, and compost piles should be inspected on a regular basis.

  EXAMPLE: Tomato plants are highly sensitive to gas. It will cause their leaves to turn downward and sometimes yellow.
- Frequent greenhouse inspections and adjustments will ensure that proper watering and ventilation levels are maintained.

### SATISFACTORY WATER ANALYSIS REPORT

| | |
|---|---|
| Water and Soil Salinity | State Lab No. 00000 |
| Testing Laboratory | Invoice No. 00000 |
| Agronomy Department | Date Tested 080688 |

## COOPERATIVE EXTENSION SERVICE
## WATER AND SOIL SALINITY TEST REPORT

Analysis: *IRRIGATION* Location: __________

Name *OK Greenhouse* Address __________ County __________

| Electrical Conductivity umhos cm | pH | Total Soluble Salts (ppm) | Sodium Absorption Rate (SAR) | Exchangeable Sodium Percentage (%) | Sodium Percentage (%) | Texture | Residual Carbonates (meg) | Hardness (ppm) |
|---|---|---|---|---|---|---|---|---|
| 700 | 7.1 | 462 | 2 | . | 60 | | 0 | . |

| PARTS PER MILLION | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sodium | Calcium | Magnesium | Nitrate N | Chloride | Sulfate | Bicarbonate | Carbonate |
| Na | Ca | Mg | N | Cl | $SO_4$ | $HCO_3$ | $CO_3$ |
| 34 | 10 | 6 | 0 | 2 | 90 | 0 | 0 |

RECOMMENDATIONS:

This water can be used *SATISFACTORILY* for most crops if care is taken to prevent accumulation of soluble salts including sodium, in the soil. Good soil management and irrigation practices should be followed. Class 3 water can be used with little danger on permeable, well-drained soils in which water can readily move through the soil.

The water table should be at least 10 feet below the surface. This allows for leaching of accumulating salts by making an occasional application of irrigation water sufficient to leach the soil if this becomes necessary because of lack of rainfall. More care is required on heavy textured soils because water does not move through the soil profile as readily as on light textured or granular, permeable soils and leaching therefore is more difficult. If this water is used extensively, it is recommended that a soil sample be obtained every few years from the irrigated fields to determine the extent to which sodium or salts may be accumulating and the need for special management practices.

Cost __________

## UNSATISFACTORY WATER ANALYSIS REPORT

Water and Soil Salinity
Testing Laboratory
Agronomy Department

State Lab No. 00000
Invoice No. 00000
Date Tested 080688

### COOPERATIVE EXTENSION SERVICE

## WATER AND SOIL SALINITY TEST REPORT

Analysis: *IRRIGATION* Location: ____________

Name *OK Greenhouse* Address ____________ County ____________

| Electrical Conductivity umhos cm | pH | Total Soluble Salts (ppm) | Sodium Absorption Rate (SAR) | Exchangeable Sodium Percentage (%) | Sodium Percentage (%) | Texture | Residual Carbonates (meq) | Hardness (ppm) |
|---|---|---|---|---|---|---|---|---|
| 4710 | 8.1 | 3109 | 14 | . | 80 |  | 5 | . |

| PARTS PER MILLION | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sodium | Calcium | Magnesium | Nitrate N | Chloride | Sulfate | Bicarbonate | Carbonate |
| Na | Ca | Mg | N | Cl | $SO_4$ | $HCO_3$ | $CO_3$ |
| 566 | 91 | 21 | 1 | 120 | 1420 | 704 | 0 |

RECOMMENDATIONS:

Water listed in this class is generally *UNSATISFACTORY* for irrigation use. It may be used for irrigation only under very special conditions and on the advice of a technician trained in irrigation water use. Use of this water should be confined to occasional use as a supplemental source of water on well-drained soils. It is not recommended for use on medium and heavy textured soils.

If this water is used extensively, it is recommended that a soil sample be obtained every few years from the irrigated fields to determine the extent to which sodium or salts may be accumulating and the need for special management practices.

Residual carbonates are present in excess amounts lowering water quality to unsuitable. Waters with too high residual carbonates may contain effective sodium in excess of that indicated by the sodium percentage of the water. The calcium and magnesium may precipitate out a lime, thus increasing the percentage of sodium.

Cost ____________

Designs for two common greenhouse irrigation systems and their maintenance requirements.

**Perimeter Irrigation System**

The perimeter system is commonly used for watering bench crops. The perimeter system is comprised of 3/4-inch plastic pipes outlining the perimeter of the bench with plastic nozzles spaced evenly on it.

Either vinyl PVC or polyethylene plastic pipe can be used in a perimeter or spaghetti system. PVC is very stationary, semirigid pipe. It is more costly than polyethylene pipe and enjoys a longer life span.

NOTE: To build a system, the installer drills holes, taps threads, and cements fittings to PVC pipe.

Polyethylene pipe is inexpensive and easy to manage. It must be anchored to the side of the bench to not allow the nozzle to roll from its proper orientation toward the growing medium. This pipe expands in warm weather and contracts in cold weather. To prevent expansion in high temperatures, the system should be installed during warm weather with the pipe stretched and anchored at each end.

NOTE: The installer uses a sharp pick to create a hole in the pipe where the nozzle will go and screws in the self-tapping nozzle.

Nozzles are constructed of nylon or hard plastic. They dispense spray arcs of 45 degrees or 180 degrees. Plastic nozzles are evenly spaced on the pipe and positioned to spray toward the center of the bench. Nozzle positions are staggered across the bench to allow one nozzle on one side to spray between two nozzles on the opposite side. This will alternate sprays and create a desirable overlay to avoid dry areas.

The space allowed between nozzles depends on the amount of foliage of bedding plants near the soil.

EXAMPLES: 180 degree nozzles spaced 30 inches apart are used for light foliage crops, such as roses or chrysanthemums, and roses on benches up to 4 feet (48 inches) wide.

180 degree nozzles spaced 30 inches apart are used for fresh flowers, other than roses, on benches up to 42 inches wide.

EXAMPLES: Installers alternate 45 degree nozzles with 180 degree nozzles about 20 inches apart for these three situations:

For crops with heavy growth near the growing medium

Fresh flowers other than roses on 48-inch wide benches

Crops on benches 48-inch wide

For perimeter systems with 180 degree nozzles, one water outlet is sufficient to water up to one 100-foot bench. Installers provide water outlets for every 50-feet of bench by adding one additional water outlet for each additional 50-feet of bench.

NOTE: For benches between 100 and 200 feet, installers position a pipe down the center of the bench to use as a main water line. They install 3/4-inch water valves on each side of the bench to service each half of the bench. This system provides 1/10 gallon of water per minute per foot of pipe.

**Spaghetti Irrigation System**

The spaghetti system is commonly used to water individual potted plants or hanging baskets.

A spaghetti or tube watering system is made up of a main water tube placed in the center of the bench with a series of smaller tubes running from the main line to each pot.

The spaghetti system saves labor costs in watering potted plants. Pipes can be either vinyl PVC or polyethylene.

EXAMPLES: Potted plants include herbs and violets. Hanging baskets may have ivy or philodendron.

Installers use 1/2-inch, 2/3-inch, or 3/4-inch black PVC or polyethylene pipe in a length adequate to run the center of the bench as the main water line.

Feeding tubes, small diameter black polyethylene tubes of equal length, are inserted directly into the holes pricked into the water main.

EXAMPLES: 0.036, 0.045, 0.060, 0.075, and 0.076

FIGURE 1

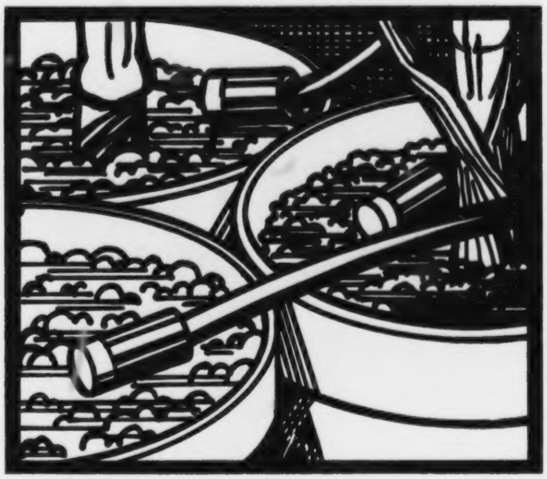

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

Narrow diameter tubes are used with smaller pots where the density on the bench is higher and the water requirement per pot is low. It also minimizes the express of laying water lines.

**NOTE:** The 0.060-size is often used with six-inch pots. The 0.075 and 0.076-sizes are used for two to five gallon containers.

Each tube extends from the main water line to the pot it will water and is secured with a weight. Weights are commonly made of plastic or other noncorrosive cylinders with the tube entering through one side.

FIGURE 2

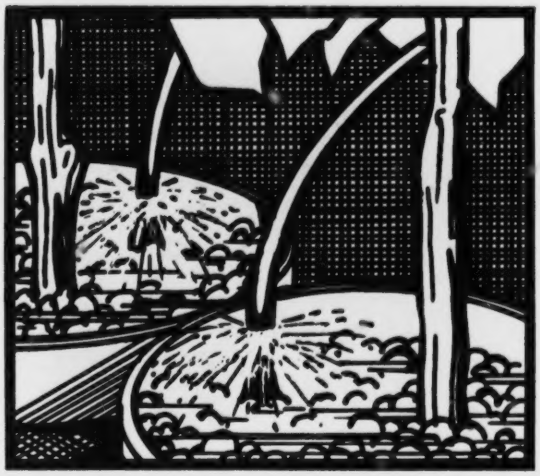

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

The weight provides these functions:

- Prevents the force of the water from throwing the tube from the pot.
- Breaks the force of the water to avoid digging a hole in the planting medium.
- Prevents light media components from clogging the tube hole.

  **NOTE:** A light suction created when the water pressure is turned off can draw small particles that can clog the tube hole.

**Maintenance**

- **Inspections**—Supervisors often use a maintenance schedule to perform periodic visual inspections on the greenhouse watering systems. In nozzle systems inspectors look for clogged nozzles that may leave some areas dry. Inspectors check those systems connected to a water source to ensure the valve has not developed a leak. A leak will keep a section of a bench waterlogged.
- **Sterilization**—Irrigation systems can be sterilized with steam and chemicals when the soil is treated.

**CAUTION: Plastic pipe softens at high temperatures so operators handle with care to avoid excess weight or stretching that may deform the pipe. Polyethylene pipe may decompose when exposed to steam. Operators raise the pipe when the soil is steamed and treat the pipe with appropriate chemicals.**

- **Life Expectancy**—The life expectancy of a watering system depends on many variables and unique environmental factors Five to six years use is generally expected from the more delicate components of the system, including polyethylene tubes and plastic nozzles. Components of more durable materials, such as PVC pipe and mental nozzles, will usually last longer.

**ASSIGNMENT SHEET 1**

# GREENHOUSE WATERING

# VI

NAME ______________________ SCORE ________

**OBJECTIVE 13**

**Describe the correct watering method for propagating plants.**

**INTRODUCTION**

The type of watering system and moisture requirements vary among greenhouse plants. Selecting the most appropriate type of equipment, specific watering methods, and other variables, such as time of day for watering, are essential to create an environment for plants to grow and thrive.

**DIRECTIONS**

Read the information in Objectives 2 and 3 and this assignment sheet. Follow the directions, then answer the questions.

1. Choose two plants suitable for these watering methods.

   a. Flat spray nozzle system

   ______________________________

   ______________________________

   ______________________________

   b. Mist system

   ______________________________

   ______________________________

   ______________________________

2. Identify the best watering system for a greenhouse germinating moss rose from seed.

   ______________________________

   ______________________________

   ______________________________

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3. A greenhouse operator wants to propagate a plant from cuttings. Choose an appropriate plant and answer these questions.

   Plant ______________________________

   a. The type of watering system best for watering the plant

      ______________________________

      ______________________________

      ______________________________

   b. The direction of the stream of water

      ______________________________

      ______________________________

      ______________________________

   c. The best time of day for watering and why

      ______________________________

      ______________________________

      ______________________________

4. Describe the watering systems used in your school greenhouse.

   ______________________________

   ______________________________

   ______________________________

   ______________________________

   ______________________________

   ______________________________

   ______________________________

   ______________________________

   ______________________________

5. Describe another watering system that you think would be an effective choice for your school greenhouse and tell why you chose it.

**ASSIGNMENT SHEET 2**

# GREENHOUSE WATERING

**VI**

NAME ______________________________ SCORE _______

**OBJECTIVE 14**

**Determine the watering needs of plants.**

**INTRODUCTION**

Plants require different quantities of water according to species, time of year, climate, and life cycle. The correct amount of water and the proper application is needed for photosynthesis and plant growth. Water levels in the soil also affect plant growth. Too much or too little water can stunt or kill a plant. An experienced operator using greenhouse watering systems can provide specific amounts of water and nutrients to plants at the needed intervals in a cost-effective manner.

**DIRECTIONS**

Read the information in Objectives 7 and 8. Write "M" in the blank if the plant needs watering more frequently and "L" if it needs watering less frequently.

**Part 1**

___ 1. It is cloudy and air is still

___ 2. A plant has sparse foliage

___ 3. The soil pulls away from the sides of the pot

___ 4. The plant is in an unglazed clay pot

___ 5. Plant is resting or dormant

___ 6. A small plant is in a large pot

___ 7. Plant has blooms and much foliage

___ 8. It is sunny and windy

___ 9. Stems are thin or woody

__ 10. You have just planted a bulb

__ 11. Plant has wide, thin leaves

__ 12. Plant is just getting established

__ 13. Plant is in a green plastic pot

__ 14. Temperature is 63 degrees

__ 15. The pot is completely filled with roots

**Part 2** Describe why it is important to apply water in proper quantities at regular intervals.

## ASSIGNMENT SHEET 3

## GREENHOUSE WATERING

**VI**

NAME ______________________________ SCORE _______

**OBJECTIVE 15**

**Calculate the water quantity for bench plants using an automatic watering system.**

**INTRODUCTION**

Frequent applications of good quality water in the correct temperature and amount creates the ideal watering situation. The formula for applying water to benches or beds is 1/15 of a gallon of water per square foot for each inch of depth.

**DIRECTIONS**

Use the procedure below to calculate the amount of water needed to water a 4 x 4 foot square bench with 8 inch walls and 7 inches of media in it.

1. Draw a square bench 4 foot by 4 foot in the space below. Indicate the bench height as 8 inches. Draw the media line at 7 inches. Label all parts and note all dimensions.

2. To find the total volume of media, use this formula: l x w x h = t. Substitute the dimensions of the bench described on the following page. Where,

   l = length in feet
   w = width in feet
   h = media height in inches
   t = total amount of media

Show your work below.

3. Apply 1/15 of a gallon of water for every square foot for each inch of depth to saturate bench soils. To arrive at the total amount of water required, use this formula:

   1/15 x t

   t is the total amount of media you calculated above.

4. Show your work below.

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**ASSIGNMENT SHEET 4**

# GREENHOUSE WATERING

VI

NAME ______________________________ SCORE ______

**OBJECTIVE 16**

**Calculate the amount of fertilizer for a proportioning pump in an automatic watering system and a hand-held hozon.**

**INTRODUCTION**

Applying the proper amount of fertilizer is essential to plant growth. Plants can be undernourished from too little or too infrequent feedings. Overfeeding and too high quantities can damage plants.

NOTE: Follow the manufacturer's instructions when using all fertilizers, watering equipment, and feeding devices.

**DIRECTIONS**

- Review these facts.

  Some proportioning pumps deliver up to 100 gallons of water per minute.

  Typical proportioning pumps use the proportion of one part fertilizer to 100 parts water. This is a 1:100 ratio.

- Use the formulas below to calculate how much fertilizer to use with proportioning pumps. You only need to know one of the two variables to calculate water and fertilizer quantities.

  $f$ = amount of fertilizer

  $w$ = amount of water

  To find fertilizer quantity, use Formula 1:

  $$f = \frac{w}{100}$$

  To find water quantity, use Formula 2:

  $$w = f \times 100$$

Use the same units of measure (gallons, liters, etc.) for the variables "f" and "w."

1. Calculate how much fertilizer to use with 300 gallons of water in a proportioning pump. Show all your work.

- Review these facts.

Standard hozon nozzles are calibrated to use one gallon of fertilizer for every 15 gallons of water. This is a 1:15 ratio.

- Use the formulas below to calculate how much fertilizer to use with hozon nozzles. You only need to know one of the two variables to calculate how much water and fertilizer to use.

f = amount of fertilizer

w = amount of water

To find fertilizer quantity, use Formula 1:

$$f = \frac{w}{15}$$

To find water quantity, use Formula 2:

$$w = f \times 15$$

Use the same units of measure (gallons, liters, etc.) for the variables "f" and "w."

2. Perform the calculation to learn how much fertilizer to use with 75 gallons of water in a hozon. Show all your work.

**ASSIGNMENT SHEET 5**

# GREENHOUSE WATERING

# VI

NAME ______________________________ SCORE ______

**OBJECTIVE 17**

**Create a line drawing of a design for an automatic watering system, label all parts, and prescribe system maintenance.**

**INTRODUCTION**

An efficiently-designed greenhouse watering system is more cost-effective than a manual watering system. Many elements contribute to its design. It's well-worth the time to design a system that best meets plant needs and greenhouse budget.

**DIRECTIONS**

Read all the information in Objective 9, Supplement 3, and this assignment sheet. Follow the directions and perform the exercise.

1. Select either the perimeter or spaghetti watering system. Draw the system including the following items in the plan. Draw your picture on the next page. Label the following items or provide answers when they apply.
    a. Identify type of watering system
    b. Pipe type or material
    c. Width of pipe
    d. Nozzle material
    e. Spray arc(s) of nozzle
    f. Approximately how many nozzles or weights will be needed
    g. Spacing between nozzles
    h. Position of nozzles or weights compared to each other
    i. Length of bench
    j. Number of water outlets
    k. Plants watered
2. Describe system maintenance on the next page.

**ASSIGNMENT SHEET 1**

1. Check that the two plants chosen are suitable for these watering methods. Examples below are from Objective 4 Information Sheet.
    a. Flat spray nozzle system: carnations, chrysanthemums, roses, and snapdragons.
    b. Mist system: Moss rose, petunia, sunflower, and other seeds. Begonias, English ivy, golden pathos, and other cuttings for propagation.
2. The mist system
3. Appropriate plants that can be propagated from cuttings are begonias, English ivy, and golden pathos. (See Objective 4 Information Sheet.) Check to see that other plants selected are appropriate for propagation from cuttings.
    a. Mist watering systems are best for propagating plants from cuttings.
    b. The mist system applies water from above the plant.
    c. The best time of day for watering is early in the day. This allows water to evaporate from wet foliage and reduces fungus growth. (See Objective Sheet 3 Information Sheet.)
4. Check that the answer is appropriate to your systems.
5. Check that the answer is appropriate to your greenhouse situation.

## ASSIGNMENT SHEET 2

### Part 1

1. L
2. L
3. M
4. M
5. L
6. L
7. M
8. M
9. M
10. L
11. M
12. L
13. L
14. L
15. M

### Part 2

Answers may include all or part of the following:

- Greenhouse watering regulates the amount of water and air in the soil.
- Water quantity depends on soil mix, plant size, pot size, humidity, and temperature.
- In benches or raised beds, apply 1/15 of a gallon of water per square foot for each inch of depth.
- Ten percent of the water applied to a pot or bench should exit from the bottom of a well-drained container.
- Do not overwater or let plants stand in waterlogged media. Excess water reduces the amount of oxygen in the soil and damages the root system. Plants develop damaged roots or "wet feet," which prevent the plant from absorbing water and nutrients to promote strong vigorous growth.
- New growth in overwatered plants may appear soft and wilt under bright light or dry conditions. The flowers wither. The leaves turn yellow and perhaps drop.
- Do not let plants wilt from lack of water. This retards photosynthesis and slows growth.

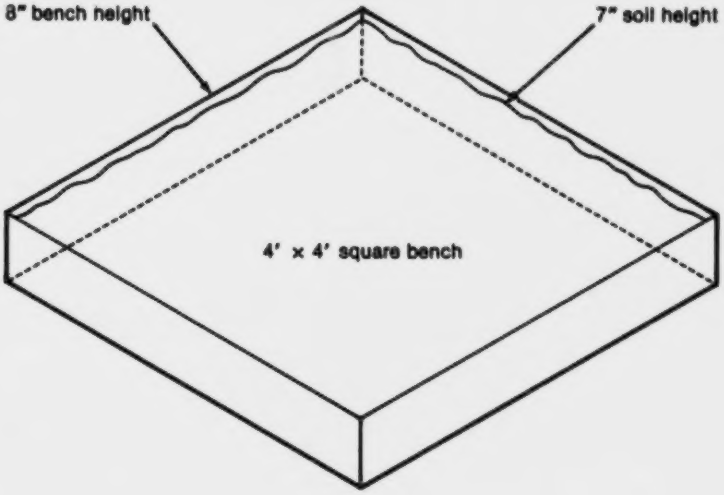
- Underwatered plants can appear hardened with smaller plant leaves and shorter lengths of stems between leaves (internodes). In some cases, leaves may appear burned or drop off.
- Do not guess when to water plants. Check a sample by knocking the root ball from the pot.
- Withhold water if water can be squeezed from the root ball or if water rests in the bottom of the container.
- Increase water frequency and amount if soil is dry and warm to touch.

**ASSIGNMENT SHEET 3**

Calculate the water quantity for bench plants using an automatic watering system.

1. Drawings may vary. The illustration below is an example. a square bench 4 foot by 4 foot in the space below. Indicate the square bench 4 foot by 4 foot in the space below. Indicate the bench height as 8 inches. Draw the media line at 7 inches. Label all parts and note all dimensions.

FIGURE 2



2. $l \times w \times h = t$
   $4 \times 4 \times 7 = t$
   $112 = t$

3. $1/15 \times t$
   $1/15 \times 112$

   $\frac{1}{15} \times \frac{112}{1}$

   $\frac{112}{15}$

   7.46 or 7.5 gallons of water

**ASSIGNMENT SHEET 4**

Calculate the amount of fertilizer for a proportioning pump in an automatic watering system and a hand-held hozon.

1. $f = \frac{w}{100}$

   $f = \frac{300}{100}$ gallons of water

   $f = 3$ gallons of fertilizer in a proportioning pump

2. $f = \frac{w}{15}$

   $f = \frac{75}{15}$ gallons

   $f = 5$ gallons of fertilizer for hozons

**ASSIGNMENT SHEET 5**

Create a line drawing of a design for an automatic watering system, label all parts, and prescribe system maintenance.

1. Refer to the information in Supplement 3 to determine drawings.

**Sample design for perimeter irrigation system**

a. Identify type of watering system—perimeter
b. Pipe type or material—PVC pipe
c. Width of pipe—3/4-inch
d. Nozzle material—plastic
e. Spray arc(s) of nozzle—180 degree
f. Approximately how many will be needed—4
g. Spacing between nozzles—about every 30 inches

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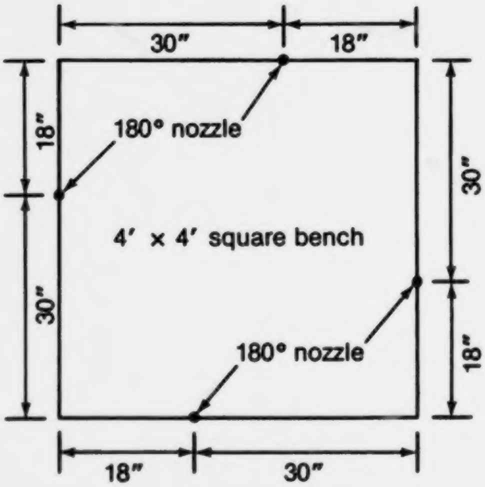
h. Position of nozzles compared to each other—staggered across from each other approximately every 30 inches
i. Length of bench—48 inch square or 4-feet by 4-feet
j. Number of water outlets—one (bench is under 100 ft)
k. Plants watered—bench crops, such as roses or chrysanthemums

FIGURE 1

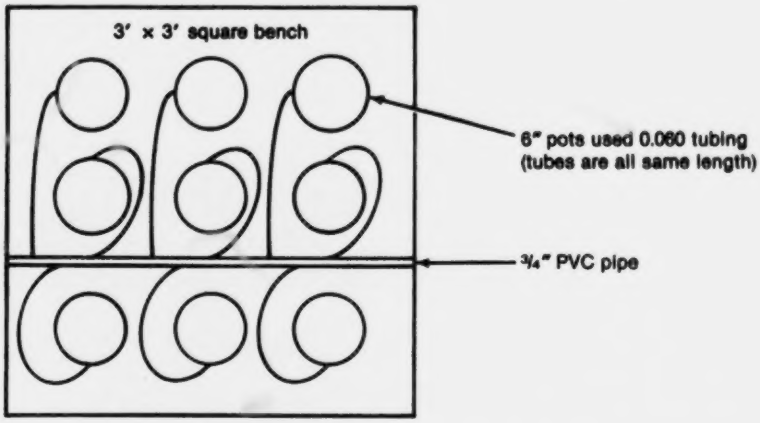


**Perimeter irrigation system**

**Sample design for spaghetti irrigation system**

a. Identify type of watering system—spaghetti
b. Pipe type or material—3/4-inch PVC down center of bench with 9 polyethylene tubes of equal length connected to it
c. Width of pipe—0.060 polyethylene tubing
d. Nozzle material—plastic or noncorrosive material
e. Spray arc(s) of nozzle—doesn't apply
f. Approximately how many weights will be needed—9
g. Spacing between nozzles—evenly space tube connections to PVC pipe
h. Position of weights compared to each other—one weight is inserted into each pot
i. Length of bench—36 inches
j. Number of water outlets—one
k. Plants watered—individual potted plants like herbs and violets

FIGURE 2



Spaghetti irrigation system

2. Describe system maintenance below or on the next page. This information is taken directly from Supplement 3. Student descriptions may vary.

   Maintain a supervision schedule by performing periodic visual inspections on the greenhouse watering systems. In nozzle systems look for clogged nozzles that may leave some areas dry. Inspect those systems connected to a water source to ensure the valve has not developed a leak. A leak will keep a section of a bench waterlogged. Irrigation systems can be sterilized with steam and chemicals when the soil is treated.

   **Optional information:** The life expectancy of a watering system depends on many variables and unique environmental factors. Five to six years use is generally expected from the more delicate components of the system, including polyethylene tubes and plastic nozzles. Components of more durable materials, such as PVC pipe and mental nozzles, will usually last longer.

**JOB SHEET 1**

## GREENHOUSE WATERING

**OBJECTIVE 18a**

**Water by hand.**

**TOOLS AND MATERIALS**

- Hand-held with spray nozzle or water breaker
- Bedding area

**PROCEDURE**

1. Turn on a hand-held hose with a spray nozzle or water breaker.
2. Adjust the spray to avoid compacting the soil.
3. Hold water spray over bedding area until water flows from drainage holes.
4. Move spray to next bedding area.
5. Have your instructor check your work.
6. Put away tools and materials and clean the work area.

NOTE: A watering can is used primarily to water small areas.

**OBJECTIVE 18b**

**Check moisture levels.**

**TOOLS AND MATERIALS**

- Potting soil
- Two clay pots
- Two ceramic pots
- Two plastic pots
- Three plastic bags of the same size and material
- Three ties
- Watering can

**PROCEDURE**

1. Select two clay, ceramic, and plastic pots of the same size and shape or as close to the same size as possible. All pots should have drainage holes.
2. Choose three plastic bags that will completely enclose one of each clay, ceramic, and plastic pots.
3. Fill each pot with potting soil to 1 inch from the top of the container.
4. Apply slight pressure to soil to lightly compress.
5. Apply water to all six dirt-filled pots until the water runs out of the drainage holes.
6. Let the pots sit until water completes draining.
7. Insert one each of the clay, ceramic, and plastic pots into to a plastic bag. Tie to create an airtight environment.
8. Select a location that receives 10 or more hours of sunlight a day.

   NOTE: Select a location that will not receive water from a sprinkler system or other watering source. If it rains, move the pots to a dry location.
9. Move the three plastic-enclosed and the three unenclosed clay, ceramic, and plastic pots to the pre-selected location.

10. Have your instructor check your work.

11. Put away tools and materials and clean the work area.

12. After several days examine and compare each set of pots.

    a. Untie and remove the three plastic bags. Set these pots slightly apart from the others.

    b. Insert your finger into the soil of each pot.

    c. Use the table to compare the moisture levels of the plastic enclosed pots with the pots exposed to the environment. Record your findings on the chart.

    d. Use the table to compare the moisture levels of each plastic enclosed pot with the pot of the same material exposed to the environment. Record findings on the chart.

13. Have your instructor check your work.

14. Put away tools and materials and clean the work area.

## COMPARISON OF MOISTURE LEVELS

| Moisture of soil media | Very Dry | Moderately Dry | Slightly Dry | Slightly Moist | Moderately Moist | Very Moist |
|---|---|---|---|---|---|---|
| Pots exposed to environment | | | | | | |
| Pots enclosed in plastic bags | | | | | | |
| Pot Types<br>Clay-open | | | | | | |
| Clay-in bag | | | | | | |
| Ceramic-open | | | | | | |
| Ceramic-in bag | | | | | | |
| Plastic-open | | | | | | |
| Plastic-in bag | | | | | | |

## JOB SHEET 3 — GREENHOUSE WATERING — VI

**OBJECTIVE 18c**

**Determine watering frequency.**

**TOOLS AND MATERIALS**

- The six clay, ceramic, and plastic pots used in Job Sheet 2
- Cane or plastic stick
- Moisture meter

NOTE: Job Sheet 3 should be completed immediately following Job Sheet 2.

**PROCEDURE**

1. Place the two groups of six clay, ceramic, and plastic pots used in Job Sheet 2 in the work area.
2. Check a sample to determine when to water plants.
   a. Insert and withdraw a cane or plastic stick into the clay pot media. Examine the cane or stick.

      NOTE: If no or little media clings to the insertion tools, moisture is absent. If some media clings to the insertion tool, adequate moisture is present. If considerable media clings to the insertion tools, too much moisture is present and withhold water.

   b. Insert and withdraw a cane or plastic stick into the other clay pot media and the four other pots. Examine the cane or stick. Assess if moisture is absent, adequate, or abundant.
3. Insert a moisture meter into select pots. Examine the meter to determine the moisture level.

   NOTE: Compare your sight and moisture meter readings.

4. Visually inspect the samples to determine moisture level and watering requirements.

   CAUTIONS: **Use care when knocking dirt free from clay and ceramic containers to avoid damaging them.**

   a. Knock the dirt from three containers.
   b. Observe if water remains in the bottom of the container.

c. Touch the dirt. Evaluate if it is dry and warm to touch or moist.

d. Squeeze the dirt and release. Determine if media crumbles, holds together, or if water can be squeezed from the media.

**NOTE:** Increase water frequency and amounts if the soil is dry and warm to touch. Cease watering if water remains at the bottom of the container or spongy to the touch.

5. Have your instructor check your work.
6. Put away tools and materials and clean the work area.

**JOB SHEET 4**

# GREENHOUSE WATERING

**VI**

**OBJECTIVE 18d**

**Check water temperature, water by hand, and leach soil.**

**TOOLS AND MATERIALS**

- Faucet
- Hose
- Watering can
- Thermometer
- A clay pot, ceramic pot, and plastic pot with drainage holes
- Gravel, pot chips, or vermiculite
- Growing medium

**PROCEDURE**

1. Use a faucet and hose to fill a watering can with water.
2. Use the thermometer to measure the ground water temperature.

   NOTE: Notice the temperature of ground water in your area. Is it tepid (72 degrees)? Must the temperature be adjusted?
3. Place 1 inch gravel, pot chips, or vermiculite in the bottom of the clay, ceramic, and plastic pot. Be sure to place large enough pieces over the drainage holes to eliminate clogging with growing medium when watered.
4. Fill each of the three pots with growing medium.
5. Use the watering can to slowly and evenly apply water to each of the three pots.
6. Continue watering until about 1/10 of the water applied runs from the bottom of each container.
7. To leach the growing medium in each pot, continue to apply water until it flows freely from the bottom of each container.
8. Have your instructor check your work.
9. Put away tools and materials and clean your work area.

## PRACTICAL TEST 1

## GREENHOUSE WATERING

## VI

**JOB SHEET 1**

**Water by hand.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Turned on a hand-held hose with a spray nozzle or water breaker. | ____ | ____ |
| 2. Adjusted the spray to avoid compacting the soil. | ____ | ____ |
| 3. Held water spray over bedding area until water flowed from drainage holes. | ____ | ____ |
| 4. Moved spray to next bedding area. | ____ | ____ |
| 5. Used proper tools correctly. | ____ | ____ |
| 6. Performed steps in a timely manner. | ____ | ____ |
| 7. Practiced safety rules throughout procedure. | ____ | ____ |
| 8. Provided satisfactory responses to questions asked. | ____ | ____ |
| 9. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

______________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| **Selected hand-held hose or water breaker** | 4 | 3 | 2 | 1 |
| **Turned water on and adjusted spray** | 4 | 3 | 2 | 1 |
| **Watered soil** | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled--Can perform job with no additional training

3 - Moderately skilled--Has performed job during training program; limited additional training may be required

2 - Limited skill--Has performed job during training program; additional training is required to develop skill

1 - Unskilled--Is familiar with process, but is unable to perform job

## GREENHOUSE WATERING

**JOB SHEET 2**

**Check moisture levels.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected two clay, ceramic, and plastic pots of the same size and shape or as close to the same size as possible. | ____ | ____ |
| 2. Chose three plastic bags that completely enclosed one of each of the clay, ceramic, and plastic pots. | ____ | ____ |
| 3. Filled each pot with potting soil to 1 inch from the top of the container. | ____ | ____ |
| 4. Applied slight pressure to soil to lightly compress. | ____ | ____ |
| 5. Applied water to all six dirt-filled pots until the water ran out of the drainage holes. | ____ | ____ |
| 6. Let the pots sit until water completed draining. | ____ | ____ |
| 7. Inserted one each of the clay, ceramic, and plastic pots into a plastic bag. Tied to create an airtight environment. | ____ | ____ |
| 8. Selected a location that received 10 or more hours of sunlight a day. | ____ | ____ |
| 9. Moved the three plastic-enclosed and the three unenclosed clay, ceramic, and plastic pots to the pre-selected location. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 10. After several days examined and compared each set of pots. | | |
| a. Untied and removed the three plastic bags. Set these pots slightly apart from the others. | _____ | _____ |
| b. Inserted a finger into the soil of each pot. | _____ | _____ |
| c. Compared the moisture levels of the plastic enclosed pots with the pots exposed to the environment. Recorded findings on chart. | _____ | _____ |
| d. Compared the moisture levels of each plastic enclosed pot with the pot of the same material exposed to the environment. Recorded findings on chart. | _____ | _____ |
| 11. Used proper tools correctly. | _____ | _____ |
| 12. Performed steps in a timely manner. | _____ | _____ |
| 13. Practiced safety rules throughout procedure. | _____ | _____ |
| 14. Provided satisfactory responses to questions asked. | _____ | _____ |
| 15. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Compared moisture content of pots | | | | |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled--Can perform job with no additional training

3 - Moderately skilled--Has performed job during training program; limited additional training may be required

2 - Limited skill--Has performed job during training program; additional training is required to develop skill

1 - Unskilled--Is familiar with process, but is unable to perform job

## GREENHOUSE WATERING

**JOB SHEET 3**

**Determine watering frequency.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Placed the two groups of six clay, ceramic, and plastic pots used in Job Sheet 2 in the work area. | _____ | _____ |
| 2. Checked a sample to determine when to water plants. | | |
| a. Inserted and withdrew a cane or plastic stick into the clay pot media. Examined the cane or stick. | _____ | _____ |
| b. Inserted and withdrew a cane or plastic stick into the other clay pot media and the four other pots. Examined the cane or stick. Assessed if moisture is absent, adequate, or abundant. | _____ | _____ |
| 3. Inserted a moisture meter into select pots. Examined the meter to determine the moisture level. | _____ | _____ |

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| The student: | YES | NO |
|---|---|---|
| 4. Visually inspected the samples to determine moisture level and watering requirements. | | |
| a. Knocked the dirt from three containers. | ____ | ____ |
| b. Observed if water remains in the bottom of the container. | ____ | ____ |
| c. Touched the dirt. Evaluated if it is dry and warm to touch or moist. | ____ | ____ |
| d. Squeezed the dirt and released it. Determined if media crumbled, held together, or if water could be squeezed from the media. | ____ | ____ |
| 5. Used proper tools correctly. | ____ | ____ |
| 6. Performed steps in a timely manner. | ____ | ____ |
| 7. Practiced safety rules throughout procedure. | ____ | ____ |
| 8. Put away tools and cleaned work area. | ____ | ____ |

## EVALUATOR'S COMMENTS

______________________________

______________________________

______________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Checked samples to determine water requirements through inspection tool | 4 | 3 | 2 | 1 |
| Used moisture meter | 4 | 3 | 2 | 1 |
| Assessed water requirements through sight inspection of soil | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled--Can perform job with no additional training

3 - Moderately skilled--Has performed job during training program; limited additional training may be required

2 - Limited skill--Has performed job during training program; additional training is required to develop skill

1 - Unskilled--Is familiar with process, but is unable to perform job

**PRACTICAL TEST 4**

# GREENHOUSE WATERING

# VI

**JOB SHEET 4**

**Check water temperature, water by hand, and leach soil.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Used a faucet and hose to fill a watering can with water. | _____ | _____ |
| 2. Used the thermometer to measure ground water temperature. | _____ | _____ |
| 3. Placed 1 inch gravel, pot chips, or vermiculite in the bottom of the clay, ceramic, and plastic pot. Placed large enough pieces over the drainage holes to eliminate clogging with growing medium when watered. | _____ | _____ |
| 4. Filled each of the three pots with growing medium. | _____ | _____ |
| 5. Used the watering can to slowly and evenly apply water to each of the three pots. | _____ | _____ |
| 6. Continued watering until about 1/10 of the water applied ran from the bottom of each container. | _____ | _____ |
| 7. Leached the growing medium in each pot. Continued to apply water until it flowed freely from the bottom of each container. | _____ | _____ |
| 8. Used proper tools correctly. | _____ | _____ |
| 9. Performed steps in a timely manner. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 10. Practiced safety rules throughout procedure. | ____ | ____ |
| 11. Provided satisfactory responses to questions asked. | ____ | ____ |
| 12. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| | 4 | 3 | 2 | 1 |
| Prepared containers to ensure proper drainage | | | | |
| | 4 | 3 | 2 | 1 |
| Filled watering can and used a thermometer to check water temperature | | | | |
| | 4 | 3 | 2 | 1 |
| Demonstrated correct hand-watering procedures | | | | |
| | 4 | 3 | 2 | 1 |
| Demonstrated correct hand-leaching procedures | | | | |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled--Can perform job with no additional training
3 - Moderately skilled--Has performed job during training program; limited additional training may be required
2 - Limited skill--Has performed job during training program; additional training is required to develop skill
1 - Unskilled--Is familiar with process, but is unable to perform job

**WRITTEN TEST**

## GREENHOUSE WATERING

**VI**

NAME ______________________________ SCORE ________

**OBJECTIVE 1**

**Match the terms associated with greenhouse watering to their correct definitions.** Write the correct letters in the blanks. (Questions are continued on the following page.)

___ 1. Evaporation process in which a plant looses moisture through small openings in the leaves

___ 2. Process to remove soluble salts from the soil by water action

___ 3. Plants grown in a raised bed in a controlled environment

___ 4. Moderately warm water at 72 degrees

___ 5. Any of the various mineral salts that can be dissolved in water

___ 6. Solid spaces containing soil or water

___ 7. A chemical frequently added to water systems to increase the body's resistance to tooth decay

___ 8. Air movement in a greenhouse

___ 9. Swelling of plant material that is the result of water stored in a plant

___ 10. The diffusion process of fluids through a semipermeable membrane until an equal amount of fluid exists on either side of the membrane

___ 11. A chemical added to water systems as a disinfectant to increase sanitation by killing germs

a. Bench-grown plants
b. Boron action
c. Capillary action
d. Capillary pores
e. Capillary suction
f. Chlorine
g. Dolomite
h. Fluoride
i. Free salts
j. Insoluble salts
k. Leaching
l. Noncapillary pores
m. Osmosis
n. Pot grown plants
o. Room temperature water
p. Semipermeable

___12. Small voids or open spaces in soil that are filled with air and allow capillary action

___13. The upward movement of fluids through the soil and plant parts

___14. Able to partially penetrate or seep through

q. Soluble salts
r. Tepid water
s. Transpiration
t. Turgidity
u. Ventilation

**OBJECTIVE 2**

**Select true statements about environmental factors that affect watering.** Circle the correct answer.

1. Watering on a fair day requires how much water compared to a cloudy day?

   a. same

   b. more

   c. less

2. The frequency of rainfall influences what in native soils?

   a. number of rocks

   b. tilt of the earth

   c. pH balance

3. Relative humidity is the amount of moisture in the air compared to________.

   a. the least amount of moisture than the air can hold

   b. the maximum amount of moisture the air can hold

   c. the amount of moisture the earth can hold

4. The ideal soil quality is a mixture of________.

   a. 50% soil, 25% capillary pores, 25% noncapillary pores

   b. 25% soil, 25% capillary pores, 50% noncapillary pores

   c. 25% soil, 50% capillary pores, 25% noncapillary pores

5. Plants grown in containers usually require how much water compared to bench-grown plants?

   a. more water

   b. less water

   c. the same water

6. Peat can hold up to ________ times its weight in water.

   a. 25

   b. 15

   c. 5

7. Higher temperatures and lower relative humidity affect moisture evaporation from all BUT________.

   a. containers

   b. plant leaves

   c. greenhouse plastic

8. Space that allows the movement of water and nutrients by capillary action is provided by________.

   a. the vermiculite-perlite mixture

   b. air in the soil

   c. cultivation

9. Waterlogged media damages roots and________.

   a. reduces the amount of oxygen in the soil

   b. dilutes the absorption of nutrients

   c. increase the capillary rate to an excessive level

**OBJECTIVE 3** **Distinguish among manual, automatic, and foliage watering systems.**

**Part 1**

1. Write the correct letters in the blanks.

A Automatic

M Manual

F Foliage

___a. Cool, damp environments promote fungus growth and disease

___b. An electronically-activated watering system that is best suited for large areas or plants that require daily or more frequent watering

___c. A hand-performed watering method best suited for cut flowers or pot plants that do not require daily watering

**Part II**

Circle the best answer

1. Water applied from below ________________.
   a. does not wet foliage
   b. washes insects from flowers and stems
   c. burns foliage
2. An advantage of overhead systems is that________.
   a. water is available to the full length of the root
   b. the water stream can wash off insects
   c. they cost less to operate than the other systems
3. Watering with an overhead automatic system during the day

   ______________________________________________

   a. enables water to soak through the roots for the maximum time
   b. allows water to evaporate from wet foliage
   c. speeds transpiration

**OBJECTIVE 4**

**Match types of watering equipment to their descriptions.** Write the correct letters in the blanks.

___ 1. An automatic method consisting of a series of nozzles mounted on standpipes that emit a fine water spray in a six-foot circular pattern that sprays over the plants.

___ 2. A manual-system watering device used to apply a large volume of water without compacting or washing the soil

___ 3. An automatic method consisting of a system of tubes placed into each plant pot

___ 4. An automatic method consisting of a system of nozzles that emit a flat water spray.

___ 5. Plants are placed on synthetic fibrous material soaked with water. Plant capillary action draws the water upward.

___ 6. Plastic pipe with nozzles is placed around the outside of a plot. The nozzles spray water over the growing medium and below the foliage.

a. Water breaker
b. Spaghetti system
c. Perimeter watering
d. Soaker hose
e. Flat spray nozzle
f. Capillary watering mats
g. Fan spray
h. Drip system nozzle
i. Mist system
j. Capillary absorption feeder

**OBJECTIVE 5**

**Select true statements about types of irrigation fertilizing equipment.** Circle the correct responses for each statement.

1. What is the difference between proportioner and hozon fertilization systems?

   a. proportioners work on percentages of water to fertilizers whereas hozons don't

   b. proportioners are easy to carry where hozons are hard to carry

   c. proportioners distribute large amounts of soluble nutrients where hozons distribute small amounts

2. For watering systems that apply water to foliage, the best watering time is________.

   a. night

   b. afternoon

   c. morning

3. What is the role of a timeclock and sensing device in greenhouse watering?

   a. Sensing devices detect environmental factors; timeclocks detect time

   b. Timeclocks predict rainfall; sensing devices detect the month and season

   c. Sensing devices detect annual growth; timeclocks predict watering cycles

**OBJECTIVE 6**

**Select true statements about proper drainage and salt build-up.** Circle the correct responses for each statement.

1. Salt build-up is removed by ________.

   a. withholding water

   b. adding fertilizer

   c. leaching

2. Which of the following statements is NOT true. Salt build-up occurs at the________.

   a. bottom of the soil from applying watering from above

   b. top of the soil from applying water from below

   c. watering through time-released pellets

3. A function of good draining is________.

   a. water flows freely

   b. containers stay clean

   c. fungus is removed

**OBJECTIVE 7**

**Complete statements about determining water quantity.**
Write the answers in the blanks.

1. ____________________ water frequency and amount if soil is dry and warm to touch.
2. Greenhouse ____________________ regulates the amount of water and air in the soil.
3. Do not overwater or let plants stand in waterlogged ______________________________.
4. Do not guess when to __________________________ plants.
5. New growth in ____________________________ plants may appear soft and wilt under bright light or dry conditions.
6. In benches or raised beds, apply ______________________ of a gallon of water per square foot for each inch of depth.
7. __________________________________ plants can appear hardened with smaller plant leaves and shorter lengths of stems between leaves (internodes).
8. __________________________ water if water can be squeezed from the root ball or if water rests in the bottom of the container.
9. _______________________ percent of the water applied to a pot or bench should exit from the bottom of a well-drained container.
10. Water ____________________ depends on soil mix, plant size, pot size, humidity, and temperature.
11. Do not let plants ____________________ from lack of water.

**OBJECTIVE 8**

**State indicators used to determine water needs of plants.**

1. List seven indicators to water less frequently.

   ________________________________________________

   ________________________________________________

   ________________________________________________

   ________________________________________________

2. List seven indicators to water more frequently.

**OBJECTIVE 9**

**Select true statements about water quality and temperature.** Circle the correct response.

1. Excessive levels of what minerals are common in ground water in the southwest?

   a. potassium and radium

   b. lead and carbon

   c. sodium and boron

2. Tepid water is ________ degrees. Applying tepid water avoids__________.

   a. 32, fungicide growth

   b. 120, plant injury from insects

   c. 72, root shock

3. Which substances ensure tests for total soluble salt readings and show acceptable levels for these additives and elements.

   a. soap, oil, and nitrogen

   b. chlorine, fluorine, and sodium

   c. fertilizers, insecticides, and fungicides

**OBJECTIVE 10** **List the advantages and disadvantages of hand watering.**

1. Name two disadvantages of hand watering.

   ______________________________

   ______________________________

2. Name two advantages of hand watering.

   ______________________________

   ______________________________

**OBJECTIVE 11** **Select true statements about the proper procedure for using a greenhouse watering system to feed plants.** Circle the correct response.

1. Which statement is NOT true?

   a. Proportioning pumps operate on water pressure. Hozons are inexpensive and manually operated.

   b. Proportioning pumps apply too much force and damage plants. Hozons apply too much fertilizer.

   c. Proportioning pumps and hozons are difficult to locate and buy.

2. Typical proportioner pumps use what ratio of fertilizer to water?

   a. 1:100

   b. 10:100

   c. 1:10

3. Standard hozons use what ratio of fertilizer to water?

   a. 1:50

   b. 1:25

   c. 1:15

**OBJECTIVE 12** **Select true statements about proper humidity and ventilation.**

Circle the correct response.

1. Plants can be seriously damaged by minute amounts of natural gas and trace particles of__________.

   a. body soap

   b. aerosol products

   c. ethylene gas

2. Seeds require what percent of relative humidity to germinate?

   a. 90

   b. 100

   c. 20

3. Which of the following suppl(y)ies oxygen required by plants, assists in removing gases, and controls plant disease?

   a. Insecticides

   b. Ventilation

   c. Clay pots

**NOTICE** The following assignment sheets and job sheets are not part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 13** **Describe the correct watering method for propagating plants.** SCORE ________

**OBJECTIVE 14** **Determine the watering needs of plants.** SCORE ________

| | | |
|---|---|---|
| **OBJECTIVE 15** | **Calculate the water quantity for bench plants using an automatic watering system.** | SCORE _______ |
| **OBJECTIVE 16** | **Calculate the amount of fertilizer for a proportioning pump in an automatic watering system and a hand-held hozon.** | SCORE _______ |
| **OBJECTIVE 17** | **Create a line drawing of a design for an automatic watering system, label all parts, and prescribe system maintenance.** | SCORE _______ |
| **OBJECTIVE 18** | **Demonstrate the ability to** | |
| | **a. Water by hand.** | RATING ______ |
| | **b. Check moisture levels.** | RATING ______ |
| | **c. Determine watering frequency.** | RATING ______ |
| | **d. Check water temperature, water by hand, and leach soil.** | RATING ______ |

**WRITTEN TEST ANSWERS**

## GREENHOUSE WATERING

## VI

**OBJECTIVE 1**

1. s
2. k
3. a
4. r
5. q
6. d
7. h
8. u
9. t
10. m
11. f
12. l
13. c
14. p

**OBJECTIVE 2**

1. b
2. c
3. b
4. a
5. a
6. b
7. c
8. b
9. a

**OBJECTIVE 3**

Part I

1. a. F
   b. A
   c. M

Part II

1. a
2. b
3. b

**OBJECTIVE 4**

1. i
2. a
3. b
4. e
5. f
6. c

**OBJECTIVE 5**

1. c
2. c
3. a

**OBJECTIVE 6**

1. c
2. c
3. a

**OBJECTIVE 7**

1. Increase
2. watering
3. media
4. water
5. overwatered
6. 1/15
7. Underwatered
8. Withhold
9. Ten
10. quantity
11. wilt

**OBJECTIVE 8**

1. Any seven of the following responses is correct:
   - A plant has few roots in a large pot.
   - A small plant is in a large pot.
   - Humidity is high or it is raining.
   - It is cloudy and the air is still.
   - Weather is cool (below 65 degrees).
   - Growth is succulent as in agaves, aloes, and cacti.
   - A plant has sparse foliage.
   - A plant is just getting established.
   - The bulb has just been planted.
   - A plant is resting or dormant.
   - A container is plastic, glazed or painted.

2. Any seven of the following responses is correct:
   - A container is unglazed clay
   - A container is completely filled with roots.
   - A large plant is in a small container.
   - The soil pulls away from the sides of the pot.
   - It is sunny and windy.
   - A plant has wide, thin leaves.
   - Stems are thin or woody.
   - A plant is a tree fern or grown on a slab of bark.
   - A plant has blooms and much foliage.
   - A plant is in active growth with good light.

**OBJECTIVE 9**

1. c
2. c
3. b

**OBJECTIVE 10**

1. It is the hidden labor costs that make it more expensive than automatic watering.

   It is difficult to gauge amounts.

2. Any two of the following responses is correct.

   Different sized plants in different types of pots can be grown on the same bench.

   Operator determines which plants need water.

   Operator inspects plants for signs of disease and stress.

   Operator selects pots or areas that dried sooner than others for watering.

**OBJECTIVE 11**

1. b
2. a
3. c

**OBJECTIVE 12**

1. c
2. b
3. b

**OBJECTIVE 13** Refer to answers to Assignment Sheet 1. SCORE ________

**OBJECTIVE 14** Refer to answers to Assignment Sheet 2. SCORE ________

**OBJECTIVE 15** Refer to answers to Assignment Sheet 3. SCORE ________

**OBJECTIVE 16** Refer to answers to Assignment Sheet 4. SCORE ________

**OBJECTIVE 17** Refer to answers to Assignment Sheet 5. SCORE ________

**OBJECTIVE 18** Refer to Practical Test for Job Sheets 1-4. RATING ________

**OBJECTIVE SHEET**

# PLANT GROWTH AND RESPONSES

# VII

**INTRODUCTION**

Knowing the parts of a plant and how it grows is essential for those who work in horticulture. Having the knowledge and skills to work effectively with plant growth and responses requires a basic understanding of the nutritional and environmental factors that affect plant growth. With this unit, covering the science of plants, you can learn what to expect from healthy plants and how to diagnose basic plant problems.

**UNIT OBJECTIVE**

After completing this unit, the student should be able to evaluate plant growth and responses and recognize environmental problems and nutritional deficiencies. The student will demonstrate these competencies by completing the assignment sheets and written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match the primary parts of a plant to their correct descriptions.
2. Label parts of monocot and dicot vascular systems.
3. Match parts of monocot and dicot vascular systems to their correct descriptions.
4. Describe types of root systems.
5. Match parts of a complete flower to their correct descriptions.
6. Describe the process and formula for photosynthesis.
7. Describe the process and formula for respiration.
8. Distinguish among cultural and environmental factors affecting plant growth.
9. Describe plant nutrients.
10. Label primary parts of a plant. (Assignment Sheet 1)
11. Label parts of a complete flower. (Assignment Sheet 2)
12. Diagnose plant environmental problems and recommend solutions. (Assignment Sheet 3)
13. Diagnose plant nutritional problems. (Assignment Sheet 4)

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Visit a local nursery or plant grower and ask for plants that exhibit nutritional or other growth problems.
- Gather a variety of plants and flowers or pictures of plants and flowers for students to identify while completing Assignment Sheets 1 and 3.
- Prepare several sets of labels for students to use in identifying the primary parts of a plant or a flower.
- Obtain several bell jars or other clear glass jars to use in demonstrating respiration.
- Prepare slips of paper with the name of one micronutrient or macronutrient on each slip. Prepare one slip for each student.

**DELIVERY**

**Objective 1**

- Show students several plants, identifying their primary parts orally.
- Give each of several students a set of labels and a plant. Ask them to attach the labels to the primary parts of the plant.
- Use Activity Sheet 1 to give each student practice in labeling the primary parts of a plant.

**Objectives 2 through 4**

- Use Activity Sheet 2 to give students practice in distinguishing between illustrations of the two types of vascular systems and their descriptions.

- Show students examples (real or illustrations) of the three types of root systems. Discuss differences in size, shape, and purpose of each type.

**Objective 5**

- Give the student a complete flower and allow him or her to identify the parts.
- Use Activity Sheet 3 to give students practice identifying the parts of a complete flower.

**Objectives 6 and 7**

- Discuss formulas as given on the Information Sheet.
- Demonstrate respiration using plants placed under bell jars or other clear glass jars. Have students observe the water that forms on the glass.
- Place one plant in the light needed for photosynthesis and an identical plant in the dark. Have students monitor changes in appearance after several days.

**Objectives 8 and 9**

- Subject plants to environmental and cultural stress. Allow the student to observe and identify the problems.
- Give each student a slip of paper with the name of a micronutrient, a secondary nutrient, or a macronutrient. Ask the micronutrients to move to one part of the room, the macronutrients to move to another part of the room, and the secondary nutrients to move to a third part of the room.

**APPLICATION**

**Objectives 10 through 13**

- Use Activity Sheet 1 and Assignment Sheet 1 to give students practice in identifying the primary parts of a plant.
- Use Activity Sheet 2 and Assignment Sheet 2 to give students practice in labeling the primary parts of a complete flower.
- Use Supplement 1 and Assignment Sheet 3 to give students the experience of diagnosing and recommending solutions to plant environmental problems.
- Use Supplement 2 and Assignment Sheet 4 to give students the experience of diagnosing plant nutritional problems.

## EVALUATION

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test sections listed in the specific objectives.
- Give written test.

  **NOTE:** Because the written test is long, it should be given in two parts.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Material**

- *Plant Propagation*, Volume 1. 1/2" VHS, color, 1987. Covers propagation by seed and specialized parts as well as division and micro-propagation.

  **NOTE:** This film is available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

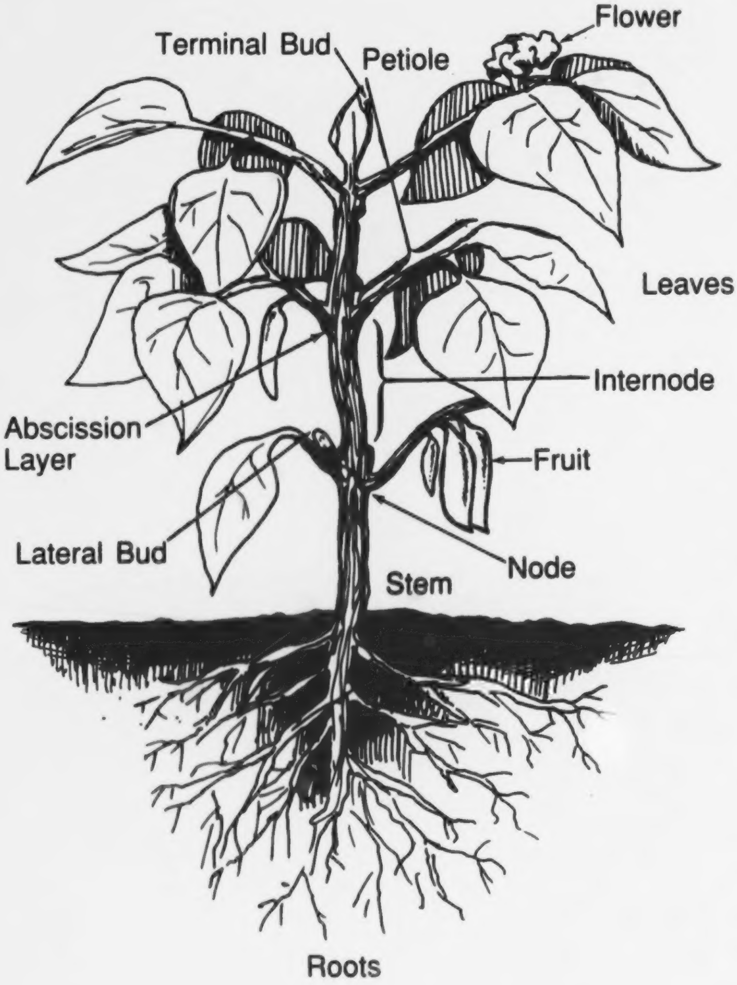
## UNIT REFERENCES

- Denison, Ervin L. *Principles of Horticulture*. New York: The MacMillan Co., 1967.
- Laurie, A; Kiplinger, D.C.; and Nelson, K.S. *Commercial Flower Forcing*. 7th ed. New York: McGraw-Hill Book Co., 1968.
- Reiley, H. Edward & Carroll L. Shry, Jr., *Introductory Horticulture*, 2nd edition. Albany, N.Y.: Delmar, 1983.
- Richardson, William B., and Moore, Gary E. *Working in Horticulture*. New York: Gregg Division, McGraw-Hill Book Co., 1980.

**OBJECTIVE 1**

**Match the primary parts of a plant to their correct descriptions.** (Activity Sheet 1, Assignment Sheet 1)

FIGURE 1


Flower
Terminal Bud
Petiole
Leaves
Internode
Abscission Layer
Fruit
Lateral Bud
Node
Stem
Roots

457

- **Root**—Serves as an anchor; supports upper plant; absorbs water and nutrients; stores food

  EXAMPLE: Sweet potatoes, beets, and carrots are specialized storage roots

- **Stem**—Supports plant leaves; transports food and water to other parts of plant; stores food
- **Node**—Joint where both leaves and buds appear on stem
- **Internode**—Portion of stem between nodes
- **Leaf**—Manufactures food for plant; stores food; controls transpiration of plant

  NOTE: Transpiration is evaporation from the inner leaf.

- **Bud**—Stores food; serves as growth site
- **Terminal bud**—Any bud growing at the tip of a stem
- **Lateral bud**—Bud appearing on the side of a stem, usually at a node

  NOTE: The lateral bud is also called the axillary (*ak*-SILL-ary) bud.

- **Flower**—Site of seed formation
- **Petiole**—The stem of a leaf
- **Abscission layer**—The place for the natural separation of flowers, fruits, or leaves from plants
- **Fruit**—A ripened ovary

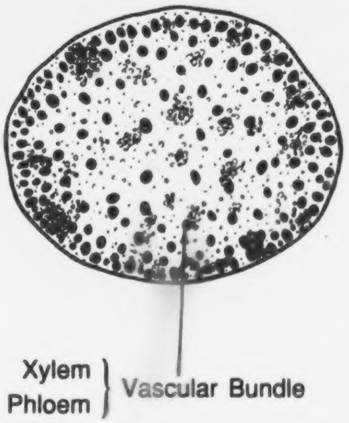
**OBJECTIVE 2**

**Label parts of monocot and dicot vascular systems.**
(Activity Sheet 2)

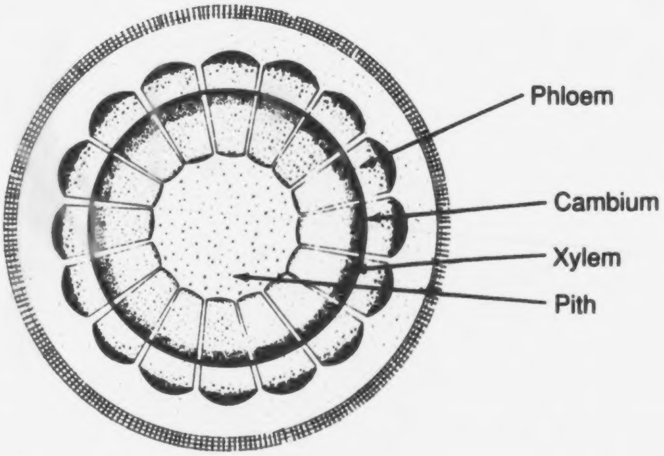
**NOTE:** Vascular means having vessels to transmit fluids.

FIGURE 2

Monocot


Xylem
Phloem
Vascular Bundle

Dicot


Phloem
Cambium
Xylem
Pith

## OBJECTIVE 3

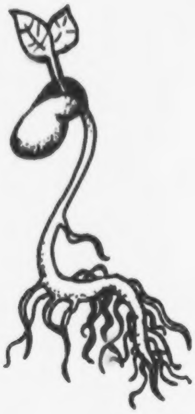
**Match parts of monocot and dicot vascular systems to their correct descriptions.**

- **Monocot**—Plant with one cotyledon in its seed
- **Dicot**—Plant with two cotyledons in its seed

NOTE: Cotyledon (cot-uh-LEE-dun)—First leaf, or seed leaf, easily seen in large seeds (Figure 3)

FIGURE 3

Dicot

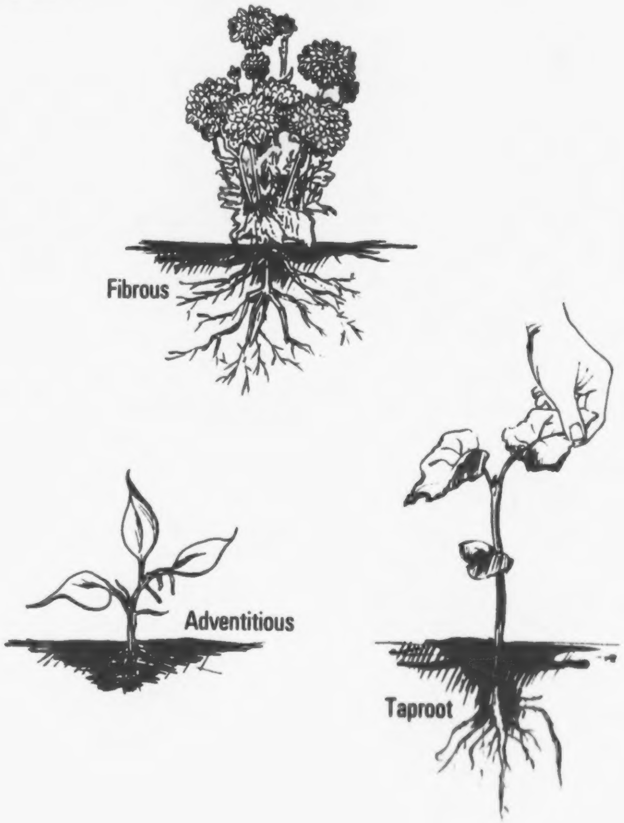


- **Xylem (ZY-lum)**—Part of plant that transfers water up from roots to leaves
- **Phloem (flom, rhymes with comb)**—Part of plant that transports food from leaves to other parts of plant
- **Vascular bundle**—Xylem and phloem combined; transport water and nutrients within the plant
- **Cambium (KAM-bee-um)**—Narrow layer of cells in vascular system of dicots that eventually becomes bark and lays down wood tissue
- **Pith**—Corky center of a dicot stem

**OBJECTIVE 4**

## Describe types of root systems.

FIGURE 4



- **Fibrous roots**—Greatly branched roots without a dominant root

  EXAMPLE: Chrysanthemums

- **Taproot**—Vertical, deep-penetrating central root with few laterals

  EXAMPLE: Pecan tree

- **Adventitious roots**—Secondary roots that appear randomly and out of the usual place

  EXAMPLES: Poison ivy, English ivy, philodendron

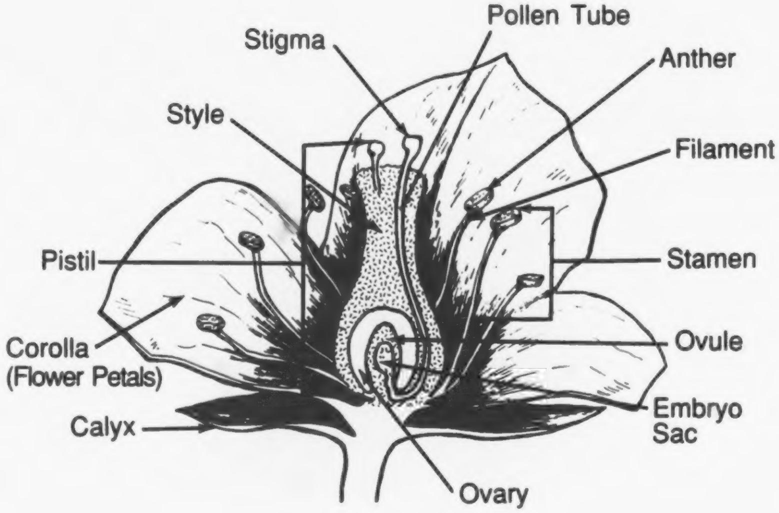
  **NOTE**: Aerial roots, roots that grow in the air instead of in the ground, are adventitious roots.

**OBJECTIVE 5**

**Match parts of a complete flower to their descriptions.**
(Activity Sheet 3, Assignment Sheet 2)

FIGURE 5

**Parts of a Flower**

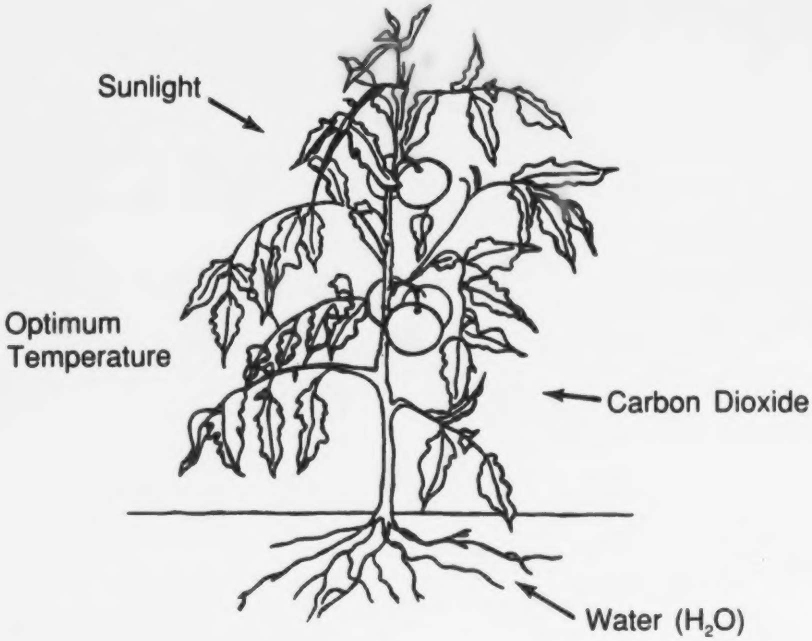

Pollen Tube
Stigma
Anther
Style
Filament
Pistil
Stamen
Corolla (Flower Petals)
Ovule
Calyx
Embryo Sac
Ovary

- **Stamens**—The male reproductive part of the flower; consists of a filament and an anther
- **Filament**—A short stalk in the male part of the flower
- **Anther**—A sac-like structure on top of the filament
- **Pistil**—The female part of the flower; located in the center of the flower; consists of a stigma, a style, and the ovary
- **Stigma**—The sticky substance on top of the pistil that catches pollen
- **Style**—A tube which leads to the ovary
- **Ovary**—The place where the egg cells develop; after fertilization, it grows to become a fruit or a seed coat
- **Pollen tube**—Produced by the pollen grain, grows down the side of the style, reaching the ovules in the ovary
- **Embryo sac**—Forms at the end of the pollen tube in the ovary
- **Ovules**—The egg cells which, when fertilized, develop into seeds
- **Corolla**—All the petals together considered as a group or unit
- **Calyx**—All the sepals together considered as a unit

**OBJECTIVE 6** **Describe the process and formula for photosynthesis.**

- **Photosynthesis**—Manufacture of carbohydrates in green plants from carbon dioxide and water

FIGURE 6


Sunlight
Optimum Temperature
Carbon Dioxide
Water ($H_2O$)

**Photosynthesis (manufacturer of food)**

$$6CO_2 + 12H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

**Respiration (reverse process)**

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$$

**NOTE**: Chlorophyll is the green coloring matter found in plants.

- Steps:
  1. Carbon dioxide ($CO_2$) is absorbed by leaves
  2. Water ($H_2O$) is absorbed by roots
  3. 6 carbon dioxide molecules + 12 water molecules in the presence of light and chlorophyll yields 1 glucose (a sugar) molecule + 6 oxygen molecules + 6 water molecules
- The plant converts sugar ($C_6H_{12}O_6$) to starches and stores them. The starches are then converted back to sugar to be used in protein, fats, or as energy

**OBJECTIVE 7** **Describe the process and formula for respiration.**

- **Respiration**—Opposite of photosynthesis; Plant uses the sugar to produce energy, water, and carbon dioxide (See Figure 6)
- Steps:
  1. Starches are converted back to sugars as the plant needs them
  2. Sugars are converted to energy
  3. 1 sugar molecule + 6 oxygen molecules yields 6 carbon dioxide molecules + 6 water molecules + energy

**OBJECTIVE 8** **Distinguish among cultural and environmental factors affecting plant growth.** (Supplement 1, Assignment Sheet 3)

- **Light**—Necessary for the manufacture of food; the source may be sunlight or artificial light; plants vary in the amount of light they require for best growth
- **Temperature**—60° to 90°; has one of the strongest effects on plant growth; some plants are cool-temperature plants (60° to 80°) and some are warm-temperature plants (75° to 90°)
- **Water**—Too much water causes root rot and too little water causes wilting

  **NOTE:** Improper watering is the most common cause of plant death. Soil should dry somewhat between waterings.

- **Humidity**—Should be 30% to 60%. When humidity is low, roots may not be able to replenish moisture lost through plant leaves as fast as it is lost, causing wilting. When humidity is too high, there is a risk of plant disease

- **Nutrition**—Plant nutrients are divided into three types: macronutrients, secondary nutrients, and micronutrients

  NOTE: Requirements depend on the individual plant.

**OBJECTIVE 9**

**Describe plant nutrients.** (Supplement 2, Assignment Sheet 4)

- **Macronutrient**—Needed by plant in large quantities: nitrogen, phosphorus, potassium

- **Secondary nutrient**—Needed by plants in moderate amounts: calcium, sulfur, magnesium

- **Micronutrient**—Needed by plant in small quantities: iron, manganese, zinc, copper, boron, molybdenum

NAME ______________________________

## GETTING TO KNOW PLANTS

Choose a plant, trace or draw it and label the following parts:

Leaves

Roots

Node

Abscission layer

Stem

Terminal bud

Lateral bud

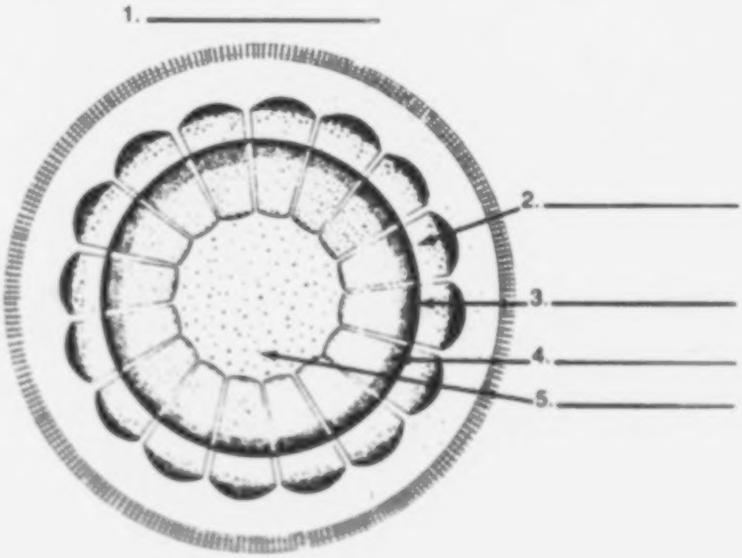
Internode

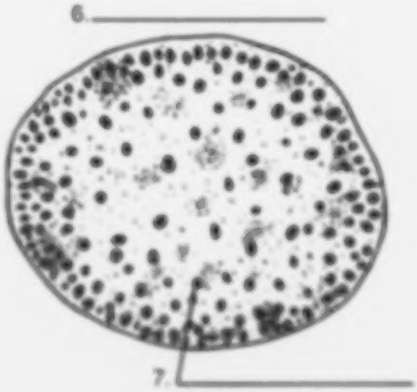
Petiole

NAME ______________________________

## MONOCOTS AND DICOTS

Practice labeling the vascular systems of the monocot and dicot shown below.





NAME ________________________________

## GET TO KNOW FLOWERS

Draw a complete flower. Label the following primary parts. Your instructor may show you a flower or you may select one.

Pistil

Corolla

Calyx

Stamen

Anther

Filament

Pollen tube

Ovule

Embryo Sac

Stigma

Style

Ovary

## TABLE 1: SYMPTOMS ASSOCIATED WITH ENVIRONMENTAL PROBLEMS OF PLANTS

| FACTOR | SYMPTOMS | CAUSE | SOLUTION |
|---|---|---|---|
| Light | Plant is "stretching." Stem is elongated between leaves. Color is pale green. Outdoor plants may thin out from too much shade. | Too low light | Move gradually to area with more light.<br>(NOTE: Do not move immediately to a high light area or sunburn may result.) |
| | Leaves are very close together. Brown patches are appearing on leaves and color is bleached. Tips of leaves may be browning. | Too much ligt | Move gradually to area with lower light. |
| Temperature | Leaves are soft, mushy and quickly turn brown or black. May occur only on leaf tips. | Cold damage | Maintain proper temperatures. Remove damaged parts.<br>(NOTE: Winds can drop temperature and cause damage.) |
| | Plant wilts quickly. On flowering, plants, flowers are bleached. Some plants may show browning on leaf edge. | Temperaturestoo high | Lower temperatures to recommended range. |
| Water | Plant is wilted and soil is extremely wet. Roots appear soft and brown. Leaves may become soft and mushy and curl. | Overwatering | Apply water less frequently and in smaller amounts. May need to replace waterlogged soil. |
| | Plant is wilted, edges of leaves may be brown. Soil is very dry; new leaves are distorted. | Underwaterin | Water more frequently without changing the amount applied. |

| FACTOR | SYMPTOMS | CAUSE | SOLUTION |
|---|---|---|---|
| Humidity | Plant leaf edges are turning brown.<br>New growth is weak and distorted. | Too low humidity | Move plant to area with higher humidity.<br>May need to place pot on a shallow pan of rocks with water in it to increase humidity.<br>(NOTE: Plants such as ferns are more sensitive to humidity than others. For these symptoms, first check light, temperature, and water.) |
| | Soft, dark areas appear on the leaves.<br>Leaves and stems may become soft, mushy and eventually rot. Soil is not waterlogged. | Too high humidity | Decrease humidity.<br>May need to move plant to new location. |

(NOTE: Cultural and nutritional factors may interact to produce symptoms similar to those described here.)

## TABLE 2: SYMPTOMS OF NUTRITIONAL DEFICIENCIES

**NOTE:** Nutritional problems may interact to produce these symptoms. Toxic means poison; toxicity means a dangerous level of poison.

| ELEMENT | DEFICIENCY SYMPTOMS |
|---|---|
| Phosphorus | Internodes are short; foliage turns purple or dark green. Older leaves die, flowering is poor. |
| Potassium | Stems are weak; leaf tips show brown areas; foliage may be mottled. Fruit is small and shriveled. |
| SECONDARY NUTRIENTS | |
| Calcium | Young leaves turn yellow and then brown. Stems are weak, growth is stunted. Growing tips bends. |
| Sulfur | Lower leaves are yellow; stems and roots are narrow; stems are brittle and break easily. |
| Magnesium | Leaves are yellow between veins of leaf; Yellowing begins at bottom of plant. Leaves are thin and tend to curl upward.<br>(NOTE: Strong light causes Mg deficiency.) |
| MICRONUTRIENTS | |
| Nitrogen | Leaves become light green and growth is stunted. Plant begins to yellow at bottom while top remains green. Yellowing begins at leaf tip and works back to the petiole.<br>(NOTE: Symptoms of nitrogen toxicity are: Plant produces all leaves and stems; does not flower or fruit; heavy application may cause top burn.) |
| Iron | Young leaves are yellow between veins while veins remain green. Symptoms appear first on new growth.<br>(NOTE: High levels of Mn may cause Fe deficiency.) |
| Manganese | Plant growth is stunted; leaves have white spots appearing between veins. Leaves have dead spots.<br>(NOTE: Strong light may cause Mn deficiency.) |
| Zinc | Buds are poorly formed; new growth is very small and clustered at end of stem. Leaves have dead areas. |
| Copper | New growth dies back. Leaves have a bleached appearance. |

47[illegible]

| ELEMENT | DEFICIENCY SYMPTOMS |
|---|---|
| Boron | Tip of growing point dies; buds are light green, no flower formation. Roots have brown center.<br>(NOTE: Amount of boron is critical; toxicity causes instant death.) |
| Molybdenum | Plant is very stunted; displays overall pale appearance; turning yellow.<br>(NOTE: Strong light may cause Mo deficiency.) |
| MACRONUTRIENTS | |
| Nitrogen | Leaves become light green and growth is stunted. Plant begins to yellow at bottom while top remains green. Yellowing begins at leaf tip and works back to the petiole.<br>(NOTE: Symptoms of nitrogen toxicity are: Plant produces all leaves and stems; does not flower or fruit; heavy application may cause top burn.) |

**ASSIGNMENT SHEET 1**

## PLANT GROWTH AND RESPONSES

## VII

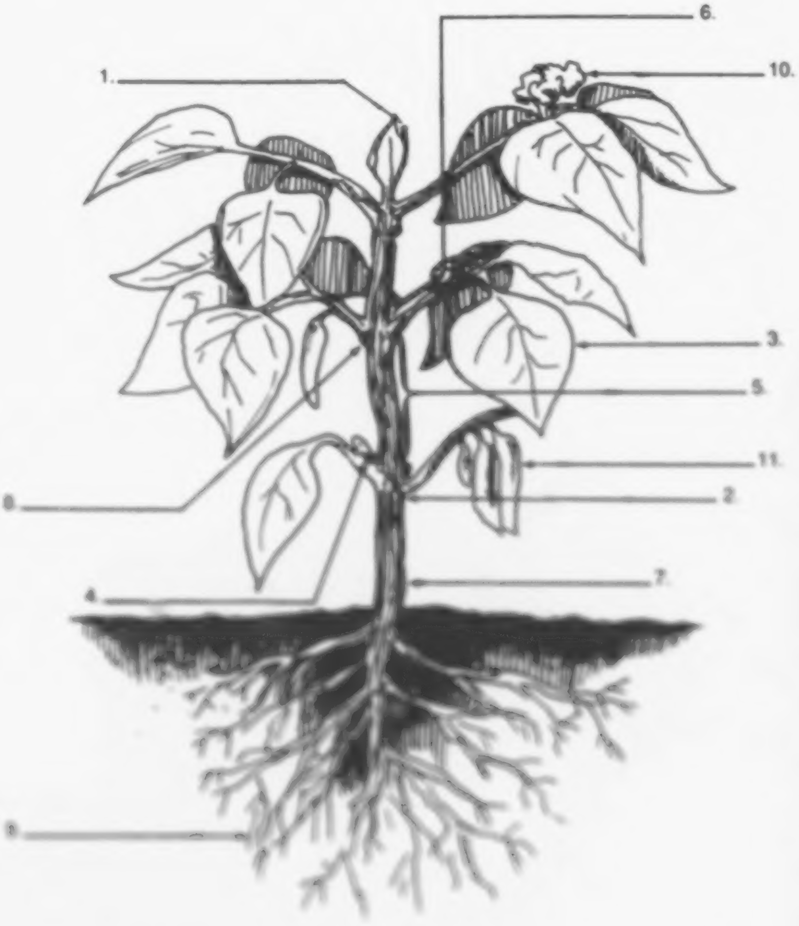
NAME ______________________________ SCORE ______

**OBJECTIVE 10** **Label primary parts of a plant to their correct descriptions.**

**INTRODUCTION** When you know the correct names of the primary parts of a plant, you will be able to talk about plants accurately and to understand information more easily.

**DIRECTIONS** Label primary parts of the plant shown below. Write the correct names in the blanks provided.

FIGURE 8



**ASSIGNMENT SHEET 2**

## PLANT GROWTH AND RESPONSES

NAME ______________________________ SCORE ______

**OBJECTIVE 11**

**Label parts of a complete flower.**

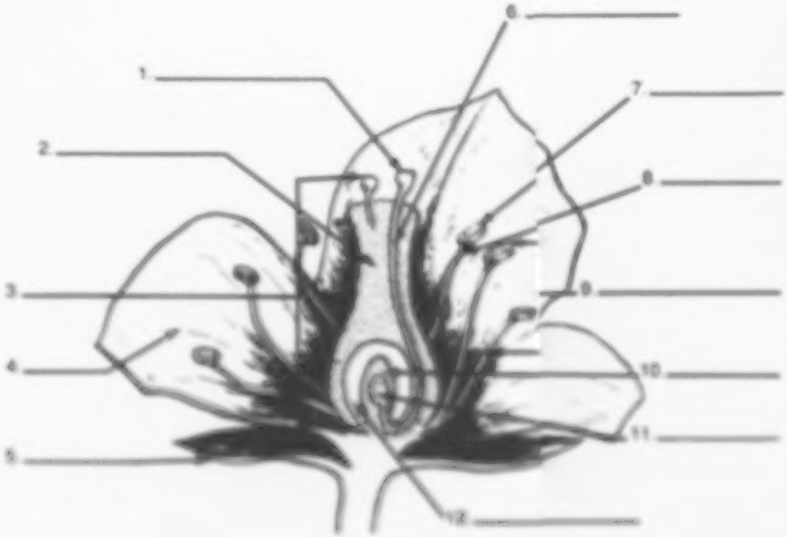
**INTRODUCTION**

In order to understand the reproductive systems of a flower and discuss problems accurately, you will need to know the correct terms to use. You will hear these terms in the greenhouse and read them in information about plants and flowers, so you should know them well.

**DIRECTIONS**

Label parts of a complete flower. Write the names in the blanks provided.

FIGURE 9



**ASSIGNMENT SHEET 3**

## PLANT GROWTH AND RESPONSES

## VII

NAME ______________________________ SCORE ______

**OBJECTIVE 12** **Diagnose plant environmental problems and recommend solutions.**

**INTRODUCTION** As a horticulturist, you will frequently be asked to diagnose plant problems. The ability to diagnose problems quickly and accurately takes practice, but it is an essential skill for anyone working with plants.

**DIRECTIONS** Analyze the situations below. State what you believe to be the most likely environmental problem. Then recommend steps to remedy it. Use Supplement 1.

1. You have a philodendron that has become lanky. The color is not as dark a green as it was originally. The plant is located about 25 ft. from an east window.

   a. Problem: ______________________________

   b. Solution: ______________________________

   ______________________________

   ______________________________

   ______________________________

2. You bought a Boston fern 3 weeks ago. Gradually you notice that the tops and edges of the leaflets are beginning to turn brown. New leaves seem weak.

   a. Problem: ______________________________

   b. Solution: ______________________________

   ______________________________

   ______________________________

   ______________________________

3. A Swedish ivy has a bleached look to its leaves. The internodes are very short and you notice some brown patches on the leaves.

   a. Problem: ____________________________________________

   b. Solution: ____________________________________________

   ____________________________________________________

   ____________________________________________________

   ____________________________________________________

   ____________________________________________________

4. A customer brings in an ivy plant that has begun to turn mushy and brown on the tips of the leaves. She carried it in from the car on a fairly windy day, but the temperature was only in the mid-40° range.

   a. Problem: ____________________________________________

   b. Solution: ____________________________________________

   ____________________________________________________

   ____________________________________________________

   ____________________________________________________

   ____________________________________________________

5. The leaves on a dogwood tree are turning brown and curling on the edges. New leaves are distorted and the soil seems dry.

   a. Problem: ____________________________________________

   b. Solution: ____________________________________________

   ____________________________________________________

   ____________________________________________________

   ____________________________________________________

   ____________________________________________________

6. The junipers planted around the base of a pecan tree are pale green and thin.

   a. Problem: ______________________________

   b. Solution: ______________________________

   ______________________________

   ______________________________

   ______________________________

   ______________________________

**ASSIGNMENT SHEET 4**

## PLANT GROWTH AND RESPONSES

## VII

NAME ______________________________ SCORE ______

**OBJECTIVE 13** **Diagnose plant nutritional problems.**

**INTRODUCTION** Nutrition plays an important part in plant growth and response. Being able to diagnose plant nutritional problems will help you to keep plants looking lush and beautiful.

**DIRECTIONS** Diagnose the following nutritional problems from their descriptions. Write in the blank the name of the nutrient that is causing the problem. If the condition is toxic (poisonous), place a star (*) after the answer. Use Supplement 2.

1. ____________________Internodes are short, older leaves have died; flowers are small and few in number, and the foliage has a purplish tint.

2. ____________________Plants with this problem have stems which break easily and are too narrow. The lower leaves of the plant will be yellowing and, when roots are checked, they appear to be small in size.

3. ____________________The buds on a plant are very small and the new growth is clustered toward the ends of the stems. Also, dead areas are appearing on the leaves.

4. ____________________An African violet has not bloomed all season. The leaves are a nice, dark green color, and the plant has been growing a great deal.

5. ____________________A peach tree flowered this year, but the fruit was small and shriveled. New stems are weak and the leaves have brown tips and a mottled appearance.

6. ____________________The leaves of a pin oak have begun to turn yellow between the veins. The top of the tree shows the worst symptoms.

7. ____________________Many of the bedding marigolds seem stunted; the leaves have white spots between the veins and some dead spots appear.

8. ______________________Within a week after receiving an application of a micronutrient mix, all the poinsettias died.

9. ______________________The leaves of a plant sitting in strong light are yellow between the veins, beginning at the bottom of the plant. The leaves are also thin and curl upward.

10. ______________________The growing tip of a zebra plant bends down, and the young leaves have turned yellow and then brown.

11. ______________________A mum plant is stunted and displays an overall pale appearance, turning yellow.

12. ______________________The leaves of a plant have a bleached appear- ance and new growth dies back.

# ASSIGNMENT ANSWERS

# PLANT GROWTH AND RESPONSES

# VII

## ASSIGNMENT SHEET 1

1. Terminal Bud
2. Node
3. Leaves
4. Lateral Bud
5. Internode
6. Petiole
7. Stem
8. Abscission Layer
9. Roots

10 Flower

11. Fruit

## ASSIGNMENT SHEET 2

1. Stigma
2. Style
3. Pistil
4. Corolla
5. Calyx
6. Pollen tube
7. Anther
8. Filament
9. Stamen
10. Ovule
11. Embryo sac
12. Ovary

## ASSIGNMENT SHEET 3

1. a. Too low light

   b. Gradually move to higher light location

2. a. Low humidity

   b. Place a shallow pan of rocks with water under the plant; move to a higher humidity location.

3. a. Too much light

   b. Move to lower light location

4. a. Cold damage

   b. Remove damaged parts and maintain proper temperatures

5. a. Too little water

   b. Water more frequently or in larger amounts

6. a. Too low light

   b. Move to higher light area; select plants more adaptable to low light

## ASSIGNMENT SHEET 4

1. Phosphorus
2. Sulfur
3. Zinc
4. Nitrogen*
5. Potassium
6. Iron
7. Manganese
8. Boron*
9. Magnesium
10. Calcium
11. Molybdenum
12. Copper

WRITTEN TEST

# PLANT GROWTH AND RESPONSES

# VII

NAME ______________________________ SCORE ______

**OBJECTIVE 1**

**Match the primary parts of a plant to their correct descriptions.** Write the correct letters in the blanks.

___ 1. Serves as an anchor; supports upper plant; absorbs water and nutrients; stores food

___ 2. The stem of a leaf

___ 3. Manufactures food for plant; stores food; controls transpiration of plant

___ 4. Any bud growing at the tip of a stem

___ 5. Supports plant leaves; transports food and water to other parts of plant; stores food

___ 6. Stores food; serves as growth site

___ 7. Site of seed formation

___ 8. Portion of stem between nodes

___ 9. Place for natural separation of flowers, fruits, or leaves from plant

___ 10. Bud appearing on the side of a stem, usually at a node

___ 11. Joint where both leaves and buds appear on stem

___ 12. Ripened ovary

a. Petiole

b. Root

c. Abscission layer

d. Lateral bud

e. Stem

f. Chlorophyll

g. Flower

h. Node

i. Bud

j. Internode

k. Leaf

l. Terminal bud

m. Cotyledon

n. Vein

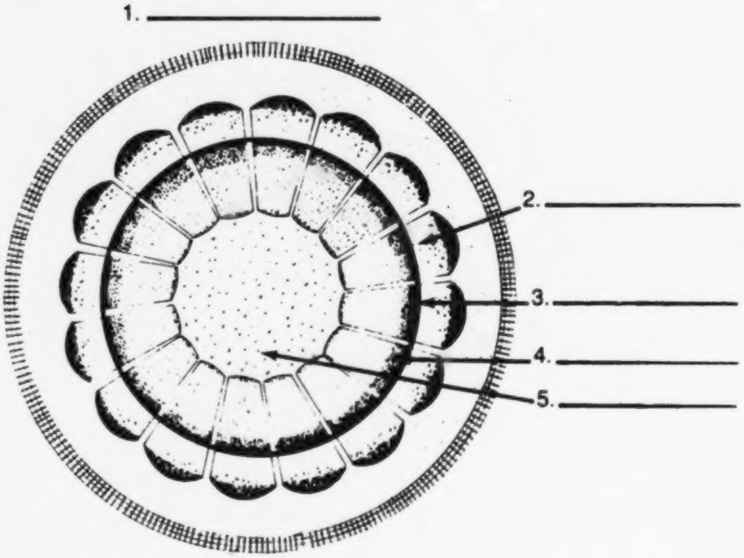
o. Fruit

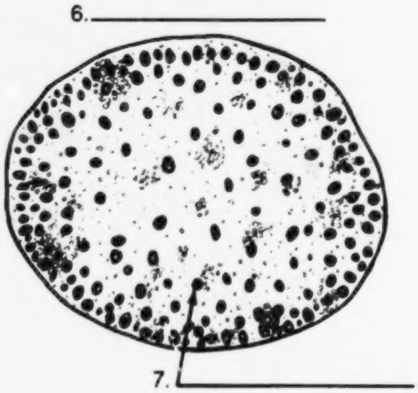
p. Seed

q. Stigma

r. Tube

**OBJECTIVE 2** **Label parts of monocot and dicot vascular systems. Write the correct names in the blanks.**





**OBJECTIVE 3**

**Match parts of monocot and dicot vascular systems to their correct descriptions.** Write the correct letters in the blanks.

___ 1. Plant with one cotyledon in its seed

___ 2. Narrow layer of cells in vascular system of dicots that eventually becomes bark and lays down wood tissue

___ 3. Part of plant that transports food from leaves to other parts of plant

___ 4. Xylem and phloem combined; transport water and nutrients within the plant

___ 5. Corky center of a dicot stem

___ 6. Part of plant that transfers water up from roots to leaves

___ 7. Plant with two cotyledons in its seed

a. Xylem

b. Bark layer

c. Monocot

d. Heartwood

e. Dicot

f. Herbaceous artery

g. Vascular bundle

h. Phloem

i. Vascular artery

j. Pith

k. Embryo

l. Cambium

**OBJECTIVE 4**

**Describe types of root systems.**

Adventitious ______________________________

______________________________

______________________________

Taproot ______________________________

______________________________

______________________________

Fibrous ______________________________

______________________________

______________________________

**OBJECTIVE 5**

**Match parts of a complete flower to their descriptions.** Write the correct letters in the blanks.

____1. The sticky substance on top of the pistil

____2. The egg cells which, when fertilized, develop into seeds

____3. A short stalk in the male part of the flower

____4. The female part of the flower; consists of a stigma, a style, and the ovary

____5. A sac-like structure on top of the filament

____6. Produced by the pollen grain; grows down the side of the style, reaching the ovules

____7. Forms at the end of the pollen tube in the ovary

____8. Male reproductive parts of the flower; consists of a filament and an anther

____9. All the petals together considered as a group or a unit

___10. Place where the egg cells develop; after fertilization, it grows to become a fruit or a seed coat

___11. All the sepals together considered as a unit

___12. A tube which leads to the ovary

a. Corolla
b. Pistil
c. Stigma
d. Ovary
e. Calyx
f. Anther
g. Pollen tube
h. Embryo sac
i. Chlorophyll
j. Filament
k. Stalk
l. Ovules
m. Stamens
n. Petal
o. Style

**OBJECTIVE 6**

**Describe the process and formula for photosynthesis.** Define photosynthesis, write the chemical formula, and then write the steps.

**OBJECTIVE 7**

**Describe the process and formula for respiration.** Define respiration, write the formula in chemical symbols, and then write the steps.

**OBJECTIVE 8** Distinguish among cultural and environmental factors affecting plant growth.

Light ______________________________

Temperature ______________________________

Water ______________________________

Humidity ______________________________

Nutrition ________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**OBJECTIVE 9** **Describe plant nutrients.** Write the definition and three examples of each type from the list below.

iron
potassium
copper
barium
manganese
molybdenum
calcium
sodium

magnesium
zinc
nitrogen
cobalt
iodine
chromium
phosphorus
hydrogen

oxygen
aluminum
boron
chlorine
hydrogen
sulfur
selenium
mercury

Macronutrients ________________________________________

________________________________________

________________________________________

Examples: ________________________________________

________________________________________

Secondary nutrients ________________________________________

________________________________________

________________________________________

Examples: ________________________________________

________________________________________

Micronutrient ________________________________________

________________________________________

________________________________________

Examples: ________________________________________

________________________________________

**NOTICE** The following assignment sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 10** **Label primary parts of a plant to their correct descriptions.** SCORE ________

**OBJECTIVE 11** **Label parts of a complete flower.** SCORE ________

**OBJECTIVE 12** **Diagnose plant environmental problems and recommend solutions.** SCORE ________

**OBJECTIVE 13** **Diagnose plant nutritional problems.** SCORE ________

## WRITTEN TEST ANSWERS | PLANT GROWTH AND RESPONSES | VII

**OBJECTIVE 1**

1. b
2. a
3. k
4. l
5. e
6. i
7. g
8. j
9. c
10. d
11. h
12. o

**OBJECTIVE 2**

1. Dicot
2. Phloem
3. Cambium
4. Xylem
5. Pith
6. Monocot
7. Vascular bundle

**OBJECTIVE 3**

1. c
2. l
3. h
4. g
5. j
6. a
7. e

**OBJECTIVE 4**

- Adventitious—Secondary roots that appear randomly and out of the usual place
- Taproot—Vertical, deep penetrating central root with few laterals
- Fibrous—Greatly branched roots with no dominant root

**OBJECTIVE 5**

1. a
2. l
3. j
4. b
5. f
6. g
7. h
8. m
9. a
10. d
11. e
12. o

**OBJECTIVE 6**

- Photosynthesis—Manufacture of carbohydrates in green plants from carbon dioxide and water
- $6CO_2 + 12H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6O_2 + 6H_2O$
- Carbon dioxide ($CO_2$) is absorbed by leaves
- Water ($H_2o$) is absorbed by roots
- Six carbon dioxide molecules + 12 water molecules in the presence of light and chlorophyll yields a sugar + 6 oxygen molecules + 6 water molecules
- The plant converts sugar ($C_6H_{12}0_6$) to starches and stores them. The starches are then converted back to sugar to be used in protein, fats, or as energy

**OBJECTIVE 7**

- Respiration—Opposite of photosynthesis; plant uses the sugar to produce energy, water, and carbon dioxide
- $C_6H_{12}O_6 + 6O \text{ ----- } 6CO_2 + 6H_2O + \text{energy}$
- Starches are converted back to sugars as the plant needs them
- Sugars are converted to energy
- One sugar molecule + 6 oxygen molecules yields 6 carbon dioxide molecules + 6 water molecules + energy

**OBJECTIVE 8**

- Light—Necessary for the manufacture of food; the source may be sunlight or artificial light; plants vary in the amount of light they require for best growth

- Temperature—60° to 90°F.; has one of the strongest effects on plant growth; some plants are cool-temperature plants (60° to 80°) and some are warm-temperature plants (75° to 90°)
- Water—Too much water causes root rot and not enough water causes wilting
- Humidity—Should be 30% to 60%; when humidity is low, roots may not be abler to replenish moisture lost through plant leaves as fast as it is lost, causing wilting
- Nutrition—Plant nutrients are divided into three types, macronutrients, secondary nutrients, and micronutrients

**OBJECTIVE 9**

- Macronutrients—needed by plant in large quantities

  Examples—nitrogen, phosphorous, potassium
- Secondary nutrients—needed by plant in moderate quantities

  Examples—calcium, sulfur, magnesium
- Micronutrients—needed by plant in small quantities

  Examples—Any 3 of the following: iron, manganese, zinc, copper, boron, molybdenum

**OBJECTIVE 10** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 11** Refer to answers to Assignment Sheet 2.

**OBJECTIVE 12** Refer to answers to Assignment Sheet 3.

**OBJECTIVE 13** Refer to answers to Assignment Sheet 4.

**OBJECTIVE SHEET**

# INTRODUCTION TO FLORAL DESIGN

# VIII

**INTRODUCTION**

Creating flower arrangements requires an artistic flair. Floral designers must enjoy working with flowers, greenery, and accessories to put together an arrangement that is pleasing to the eye. Arrangements can be constructed with fresh, dried, or silk flowers and foliage, depending on the desired result. Flowers are used to express emotion or feelings, and care must be taken to select and arrange flowers to convey those feelings. A floral designer who has a good knowledge of tools, materials, containers, and types and uses for various cut flowers and foliage will be able to fill any kind of customer order.

**UNIT OBJECTIVE**

After completing this unit, the student should be able to describe the uses for various tools, materials, and containers used in floral design and be able to identify various types of arrangements. In addition, the student should know characteristics of various cut flowers and foliage and should be able to prepare and care for cut flowers and be able to put together various floral arrangements. The student will demonstrate these competencies by completing assignment sheets, job sheets, practical tests, and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with floral design to their correct definitions.
2. Match tools used in floral design to their correct uses.
3. Describe common materials used in floral design.
4. Match common wire sizes to their correct uses.
5. Match common ribbon sizes to their correct uses.
6. Describe uses for common types of floral containers.
7. Select from a list guidelines for using color in floral design.
8. Define the basic principles of design.
9. Identify basic types of floral arrangements.

10. Recall uses, shapes, and examples of types of flowers and foliage used in floral design. (Assignment Sheet 1)

11. List characteristics of common cut flowers and foliage used in floral design. (Assignment Sheet 2)

12. Demonstrate the ability to

    a. Prepare and care for cut flowers. (Job Sheet 1)

    b. Make a bud vase arrangement. (Job Sheet 2)

    c. Wire a flower using the piercing method. (Job Sheet 3)

    d. Wire a flower using the hook wire method. (Job Sheet 4)

    e. Make a corsage bow. (Job Sheet 5)

    f. Make a boutonniere. (Job Sheet 6)

    g. Make a two-flower corsage. (Job Sheet 7)

    h. Create a symmetrical arrangement. (Job Sheet 8)

    i. Create an asymmetrical arrangement. (Job Sheet 9)

    j. Make a wreath. (Job Sheet 10)

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Gather books, catalogs, charts, and posters that deal with floral design.
- Purchase copies of "Fresh Flower Identification Chart," available from the Curriculum and Instructional Materials Center (1989-1990 catalog), 1500 West Seventh Ave., Stillwater, OK 74074-9990.
- Contact your local county or cooperative extension horticulturist for recent literature and facts sheets related to the topic.
- Arrange for guest speakers from local floral shops.

  **NOTE:** Supply guest speaker with objectives and other appropriate sections of the unit and information to be covered.

**DELIVERY**

- Discuss the unit and specific objectives. Emphasize how the specific objectives will lead to meeting the unit objective and how reaching the unit objective is vital in horticulture careers. Relate the objectives to your introduction and to previous class material.

**Objective 1**

- Use Information Sheet, Objective 1, to discuss terms and definitions related to floral design.
- Show students examples or illustrations of the terms.

**Objectives 2 and 3**

- Use Information Sheet, Objectives 1 and 2, to discuss tools and common materials used in floral design.
- Put together a bulletin board showing the tools and materials used in floral design and label each item. Later, you can remove the labels and use the bulletin board to test students on identification of the tools and materials.
- Discuss tool safety and proper use of each of the tools. Show students how to use a knife properly and how to use a glue gun. Caution students NOT to touch the glue while it is still hot.
- Show students examples of the various materials. Have students bring in examples of floral containers from home; discuss how each container could be used.

**Objectives 4 and 5**

- Use Information Sheet, Objectives 4 and 5, to discuss common wire sizes and common ribbon sizes and their uses.
- Discuss the use of wire holders, which can be labeled to make it easier to find the correct size of wire for the job.
- Show students examples of wired flowers and arrangements and have them determine what gauge wire was used for the job.
- Show students examples of corsages, arrangements, and potted plants decorated with bows and have them determine the size of the ribbon.

**Objective 6**

- Use Information Sheet, Objective 6, to discuss floral containers and their correct uses.
- Show students examples of each of the containers.
- Discuss the importance of selecting the proper container for the job. A container should not overpower the arrangement or detract from the floral design.
- Have students bring in a floral container from home and discuss what kind of flowers or arrangement would be appropriate.

- Discuss the various materials used in containers: glass, ceramic, plastic, wood, metal, etc. Explain that some containers may require an inner lining to hold the arrangement.

**Objective 7**

- Use Information Sheet, Objective 7, to discuss the use of color in floral design.
- Have students discuss how colors make them feel—how colors can create a mood or feeling.
- Use Supplement 1 to discuss the color wheel and primary, secondary, and tertiary colors; describe cool and warm colors. Have students write down some popular color combinations.
- Give students an outline of a color wheel and have them color it in using colored pencils, paints, etc.
- Discuss common color combinations used in arrangements.
- Use "Fresh Flower Identification Chart" to determine which flowers would work well together in an arrangement.

**Objective 8**

- Use Information Sheet, Objective 8, to discuss the basic principles of design.
- Discuss why design is important in creating floral arrangements and how the elements work to create a design that is pleasing to the eye.
- Show students examples of arrangements that exemplify the principles of design.

**Objective 9**

- Use Information Sheet, Objective 9, to discuss types of floral arrangements.
- Show students examples of arrangements and have them identify the types; have them explain how they identified the various types.
- Construct a bulletin board with the various types of floral arrangements; have students label the designs.

- Have a florist speak to the students about floral designs and describe which are simple and which are more difficult to create.
- Discuss the use of dried or silk flowers in arrangements.

**APPLICATION**

**Objectives 10 and 11**

- Discuss the chart on the four categories of flowers and foliage; show examples of each.
- Identify types of flowers and foliage using the "Fresh Flower Identification Chart."
- Have students complete Assignment Sheet 1.
- Discuss a list of common cut flowers and foliage and their characteristics in Supplement 2; use the "Fresh Flower Identification Chart" or slides to identify the various plants.
- Discuss common uses for the various types of flowers and show examples of arrangements incorporating the various flowers.
- Go over the cost of various cut flowers and foliage; have students make a list of some of the flowers and determine the cost by visiting a floral shop or going through catalogs.
- Determine the costs of various flowers on the "Fresh Flower Identification Chart" by going through catalogs or visiting florists.

**Objective 12**

- Go over information on Job Sheets 1 through 10; show students materials that are needed for each job.
- Describe how the jobs may differ depending on availability of materials and types of materials desired. For example, you may want to use dried or silk flowers when making bud vases or arrangements. In addition, wreaths could be constructed with readily-available juniper branches.
- Review the use of color in floral arrangements.
- Allow students to practice the jobs outlined in Job Sheets 1 through 10.
- Have students complete Job Sheets 1 through 10.

## EVALUATION

**Practical test**

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

**Written test**

- Explain to students that they will be asked to demonstrate on the written test those actions listed in the specific objectives.
- Give written test.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest as necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *The Flower Identification Slide Set Series*. Each of the four sets of 25 slides includes a student workbook featuring major design traits such as seasonal availability, vase life, and uses.
    - Slide Set 1: Carnations, roses, marigolds, stock, baby's breath, pompon chrysanthemums, etc.
    - Slide Set 2: Lady Slipper, Butterfly orchids, heather, freesia, anemones, tulips, eucalyptus, calendula, bachelor buttons, etc.
    - Slide Set 3: Lilies of the valley, maidenhair fern, gardenia, proteas, etc.
    - Slide Set 4: Guernsey Lily, Red Ginger Blossom, Arctic Poppy, Queen Anne's Lace, etc.
- *Materials and Methods*. Filmstrip. Film simplifies the concepts of proportions and scales to help students create successful arrangements, whether they prefer Ikebana, continental, or western design. Tools and techniques used by floral designers are introduced.

- *Basic Floral Techniques*. Filmstrip. Film emphasis is on clutch, pierce, and hairpin wiring followed by a demonstration of making bows and using ribbon.

  **NOTE:** The latter slides and filmstrips are available from Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407; call 1-800-235-4146.

- *Elementary Floral Information*. 45 minutes. This video helps people with no previous design background to use wire, floral tape, and foam. It includes bow-making, construction of a simple corsage, and an elementary round mound.

- *Simple Corsages*. 65 minutes. This video shows two boutonniere ideas—one using carnations and the other using silk lilies of the valley. It also demonstrates the design of four simple corsages.

- *Three Arrangement Styles*. 60 minutes. A step-by-step video covers three unique arrangements.

  **NOTE:** These videos can be ordered from: American Nurseryman, Attn: Book Dept., 111 N. Canal St., Chicago, IL 60606-7203. Call 1-800-621-5727.

**Computer software**

- *Agri-Quiz*. Plant identification, questions and answers on computer disks for IBM PC or compatible, 640K. Asks 25 questions over each area of horticulture, including floriculture. Allows individual and team competition.

  **NOTE:** Available from Midwest AGribusiness Services, Inc. 6739 Glacier, West Bend, Wisconsin 53095-9360.

## UNIT REFERENCES

**Publications**

- Anderson, Gary A. *Floral Design and Marketing*. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, The Ohio State University, 1988.
- *Catalog of Professional Horticulture Books & Video Tapes & Audio Cassettes*, Catalog No. 5. Chicago, Illinois: American Nurseryman Publishing Co., 1989.
- *Floral Design Techniques*. Lansing, Michigan: The John Henry Company, 1987.

- Ingels, Jack E. *Ornamental Horticulture: Principles and Practices*. Albany, New York: Delmar Publishers Inc., 1985.
- McDaniel, Gary L. *Floral Design and Arrangement*. Reston, Virginia: Reston Publishing Company, Inc., 1981.
- Reiley, H. Edward and Carroll L. Shry, Jr. *Introductory Horticulture*. Albany, New York: Delmar Publishers Inc., 1988.
- Stratman, Tressa S. *Retail Floriculture*, Book II. Columbus, Ohio: Ohio Agricultural Education Curriculum Materials Service, The Ohio State University, 1976.

**INFORMATION SHEET**

# INTRODUCTION TO FLORAL DESIGN VIII

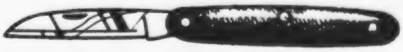
**OBJECTIVE 1** **Match terms associated with floral design to their correct definitions.**

- **Accessories**—Items used to support a floral design, such as a candle or fruit
- **Asymmetrical**—An arrangement that is basically a right angle form; the weight on either side of the center line is not the same
- **Boutonniere**—A flower or small grouping of flowers worn by a man, usually on a jacket lapel
- **Calyx**—The sepals of a flower; may form a cone around the petals
- **Common name**—The name by which a plant is generally known
- **Corsage**—A flower or grouping of flowers, net, bow, or other accessories to be worn by a woman
- **Filler**—A type of flower used to add interest and complete a design
- **Floral design**—The art of creating arrangements from flowers and foliage
- **Foundation**—Substance that holds the plant materials in place
- **Glamellia**—A corsage made to resemble a camellia flower; usually constructed from gladiolus petals
- **Line**—A design element that uses materials to form an outline or skeleton
- **Mass**—A closely spaced grouping of flowers in an arrangement
- **Symmetrical**—An arrangement that has its spine or main line of weight through the center with equal weight on either side of that center line
- **Wire gauge**—Thickness of wire

**OBJECTIVE 2** **Match tools used in floral design to their correct uses**

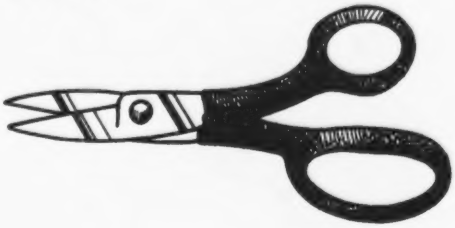
- **Knife**—Used to cut thin-stemmed flowers and foliage (Figure 1)

FIGURE 1



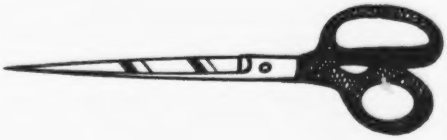
- **Floral shears**—Used to cut medium-sized stems of flowers and foliage (Figure 2)

FIGURE 2



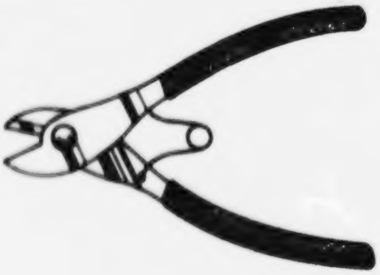
- **Ribbon shears**—Used to cut ribbon or trim foliage (Figure 3)

FIGURE 3



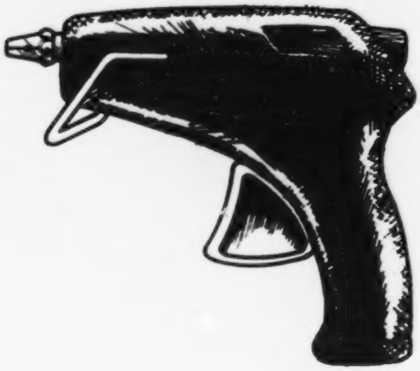
- **Wire cutters**—Used to cut wire and silk or plastic flowers (Figure 4)

FIGURE 4



- **Glue gun**—Used to secure foam into containers, add trim (Figure 5)

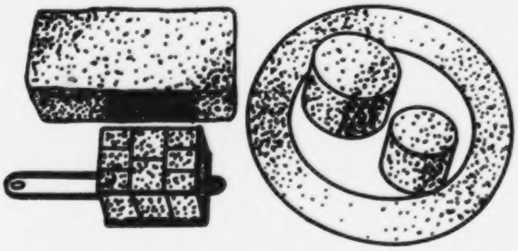
FIGURE 5



**OBJECTIVE 3** **Describe common materials used in floral design.**

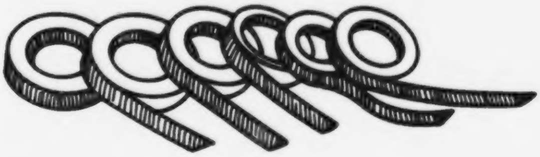
- **Floral foam**—A light-weight material that absorbs water and is used to support flowers in arrangements (Figure 6)

FIGURE 6



- **Floral tape**—A self-sealing tape used to cover stems or wires; often used in corsage or bridal work (Figure 7)

FIGURE 7



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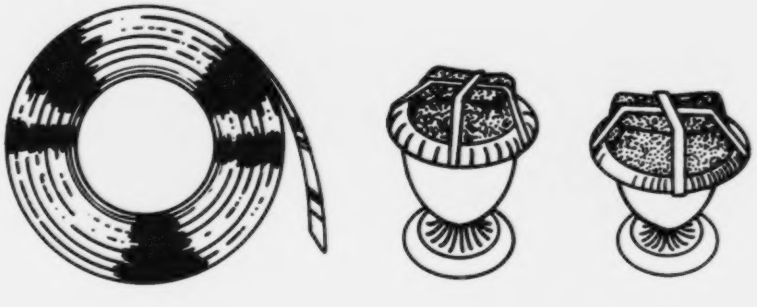
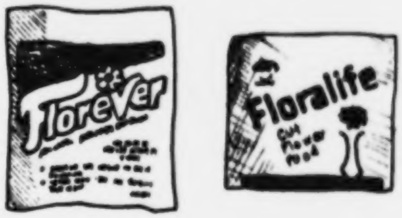
- **Waterproof tape**—Tape used to hold floral foam in a container; only adheres to clean, dry surfaces (Figure 8)

FIGURE 8



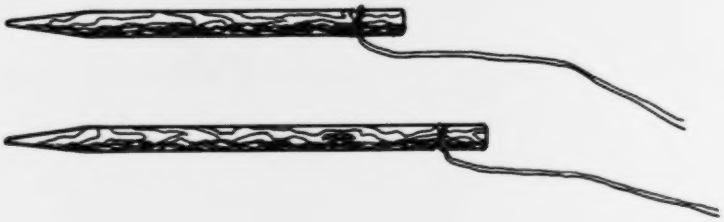
- **Floral preservative**—A solution added to water to help extend the life of a cut flower and foliage (Figure 14)

FIGURE 9


Florever
Floralife
Cut Flower Food

- **Wire pick**—Thin stick with wire attached used to support the base or stem of the flower (Figure 10)

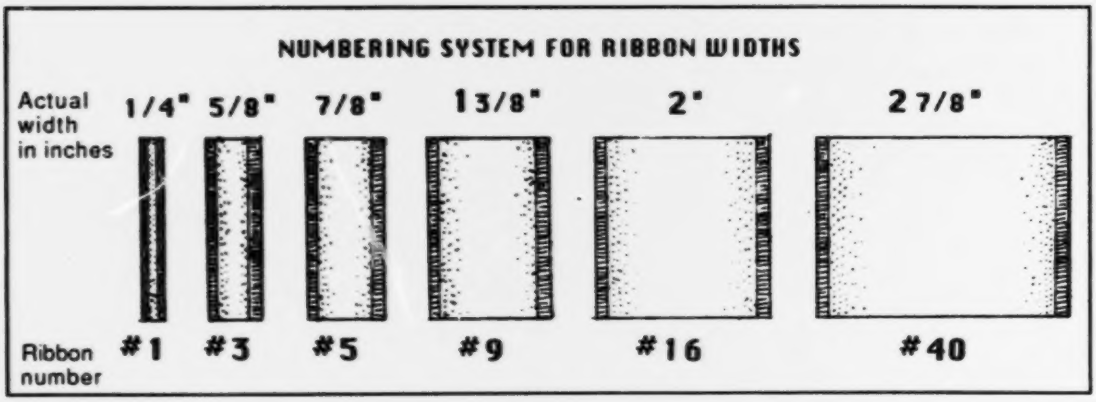
FIGURE 10



- **Ribbon**—Accessory used to decorate corsages, arrangements, and plants (Figure 11)

**NOTE:** Ribbon widths are identified by numbers—the wider the ribbon, the larger the number.

FIGURE 11


NUMBERING SYSTEM FOR RIBBON WIDTHS
Actual width in inches
1/4"
5/8"
7/8"
1 3/8"
2"
2 7/8"
Ribbon number
#1
#3
#5
#9
#16
#40

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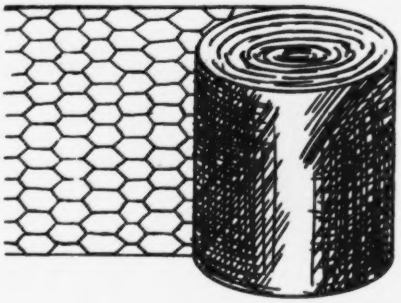
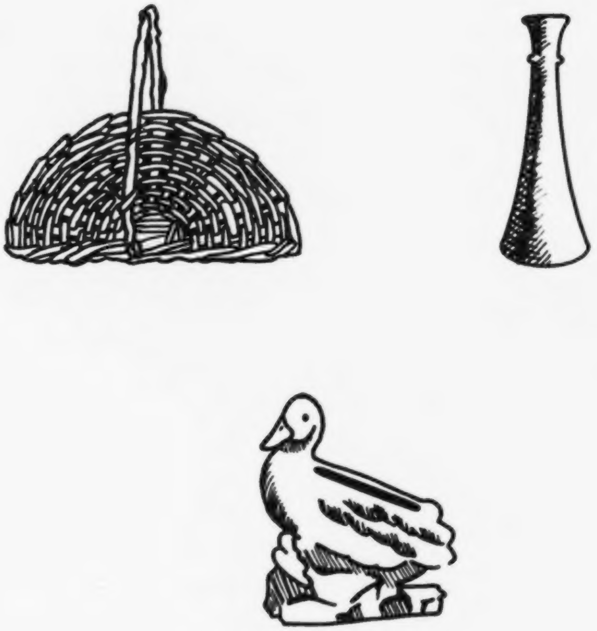
- **Wire netting** (or chicken wire)—A wire mesh used as a stem support aid; can be used alon, filled with shredded foam, or used to cover a solid floral foam block (Figure 12)

FIGURE 12



- **Floral containers**—Containers used to hold arrangements; can be made from a variety of materials (Figure 13)

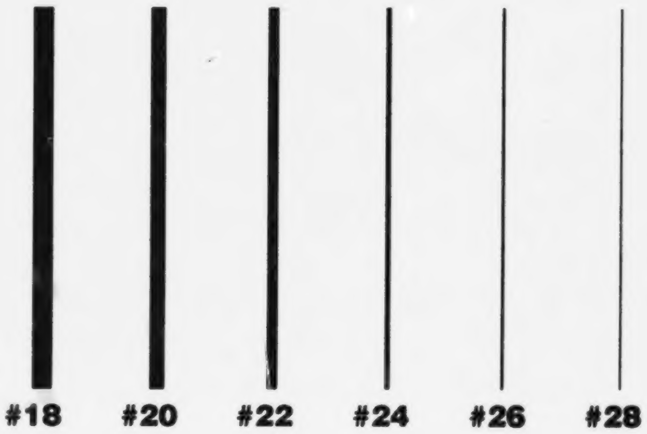
FIGURE 13



- **Floral wire**—Wire used to strengthen the stems of flowers or foliage, straighten crooked stems, strengthen flower heads, or replace natural stems of flowers or foliage (Figure 9)

  NOTE: Wire comes in different gauges or thicknesses. The gauge numbers increase as the wire diameters decrease.

FIGURE 14



**OBJECTIVE 4**

**Match common wire sizes to their correct uses.**

- 16-20 gauge—Used to support larger flower stems or heavy flowers such as gladiolis, lilies, snapdragons
- 20-22 gauge—Used to support flowers such as roses, carnations, chrysanthemums
- 24-26 gauge—Used to replace flower stems in corsages, wedding bouquets
- 28-30 gauge—Used for delicate corsage work

**OBJECTIVE 5** **Match common ribbon sizes to their uses.**

- No. 3—Used for corsages and bud vases
- No. 9—Used to decorate blooming plants, green plants, and rose arrangements
- No. 40—Used for wedding accessories and funeral arrangements

FIGURE 15

# 3 Ribbon

# 9 Ribbon

# 40 Ribbon

**OBJECTIVE 6**

**Describe uses for common types of floral containers.**

- Tall vase—Used for long-stemmed flowers
- Low bowls or oblong trays—Used for many types of arrangements; used primarily for centerpieces
- Goblet—Used for medium-sized arrangements
- Urn—Used for medium-sized arrangements
- Pedestal—Used for medium-sized arrangements
- Baskets—Used for large arrangements
- Deep bowls—Used for large arrangements

**OBJECTIVE 7**

**Select from a list guidelines for using color in floral design.** (Supplement 1)

Color is one of the most important factors in flower arrangements. Colors create a mood or feeling and offer a means of expression. Understanding the color wheel is helpful in developing interesting color combinations that are pleasing to the eye.

- Repeat colors in a design
- Don't create confusion by using too many different colors
- Allow one color to dominate the arrangement
- Place darker colored flowers lower and deeper into arrangement
- Use bright colors sparingly so as not to dominate the arrangement
- Select color contrasts to match the mood of the occasion

  EXAMPLES: Black and orange for Halloween; pinks and blues for weddings

**OBJECTIVE 8**

**Define the basic principles of design.**

- **Balance**—A steady and stable appearance
- **Proportion**—The size relationships of leaves, flowers, foliage, and the container

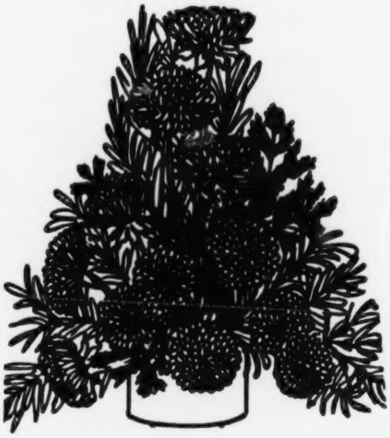
- **Rhythm**—The creation of visual movement or continuity in a design
- **Focal point**—Area to which a person's attention is immediately drawn
- **Harmony**—A look established when all parts of the floral design appear as if they belong together

**OBJECTIVE 9**

**Identify basic types of floral arrangements.**
(Assignment Sheet 1)

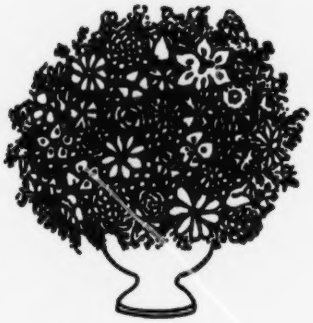
Mass arrangements are usually triangular or circular; line or line mass arrangements can be straight line variations or curved line variations. (Line-mass arrangements contain more flowers than line arrangements.)

FIGURE 16



Triangular

FIGURE 17



Circular

NOTE: Triangular arrangements can be symmetrical or asymmetrical

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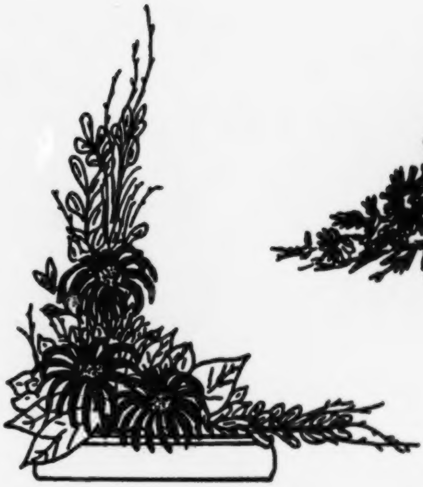
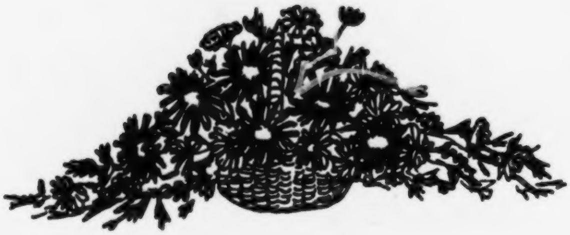
FIGURE 18



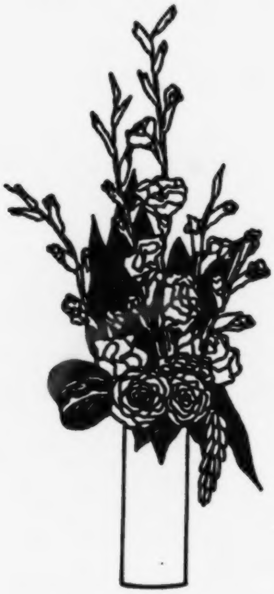
L-Shape

FIGURE 19



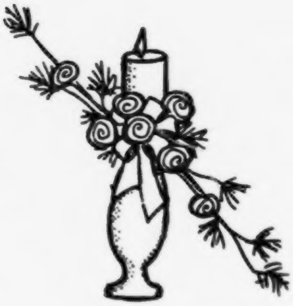
Horizontal

FIGURE 20



Vertical

FIGURE 21



Diagonal

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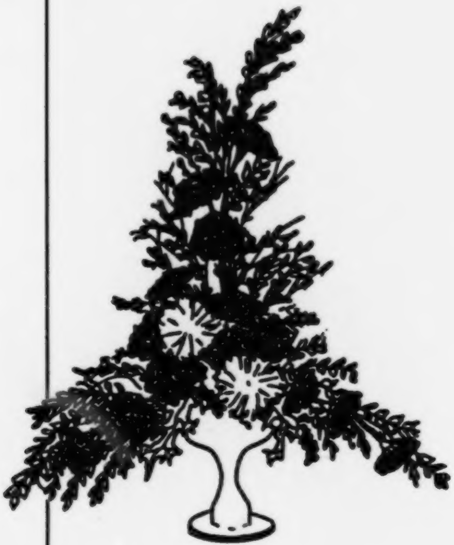
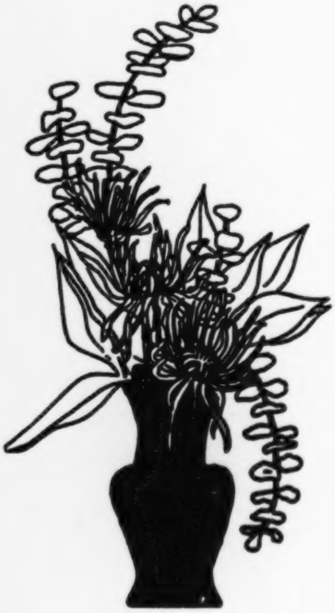
FIGURE 22



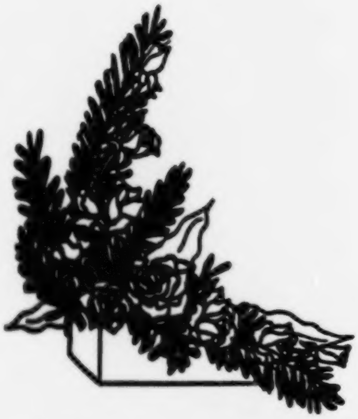
Inverted T-shape

FIGURE 23



Hogarth curve

FIGURE 24



Crescent

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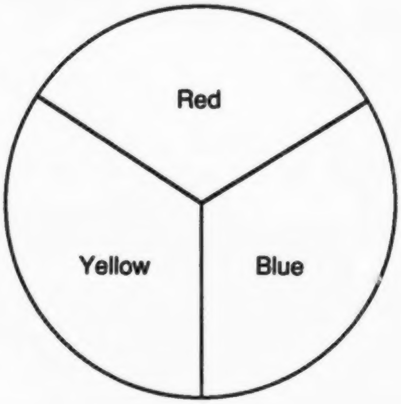
## COLOR

**Primary colors**—Three colors from which all other colors are made

- Red
- Blue
- Yellow

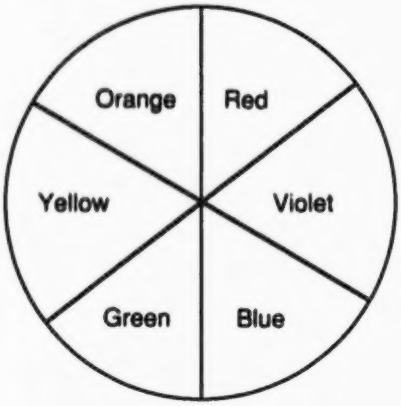
FIGURE 1


Red
Yellow
Blue

**Secondary colors**—created by mixing primary colors

- Orange (red + yellow)
- Purple (blue + red)
- Green (blue + yellow)

FIGURE 2


Orange
Red
Yellow
Violet
Green
Blue

Warm: Red, orange, yellow, brown

Cool: Blue, green, violet, white

Neutral: Black, Gray

Hue—A color on the color wheel

Value—The lightness or darkness of a hue

Tint—Lighter value of a hue created by adding white

Shade—Darker value of a hue created by adding black

Tone—Variation of a hue created by adding gray

**INTRODUCTION**

The following is a list of common cut flowers and foliage used in floral design and their characteristics.

*CUT FLOWERS*

**Common name:** Alstroemeria (also Peruvian Lily, Chilean Lily, Lily-of-the-Incas)
**Botanical name:** *Alstroemeria hybrid*
**Colors:** White, pink, yellow, red, green, and mauve
**Design:** Form; clusters of blooms on lateral stems can be used as mass
**Uses:** Arrangements
**Vase life:** 5-7 days in water, depending on surroundings

---

**Common name:** Baby's breath
**Botanical name:***Gypsophila paniculata*
**Colors:** White
**Design:** Filler
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** 5-7 days; up to one year dried

---

**Common name:** Bird of Paradise
**Botanical name:** *Strelitzia reginae*
**Colors:** Dark orange outer petals with deep blue inner petals; resembles a tropical bird
**Design:** Form
**Uses:** Arrangements
**Vase life:** 7-10 days

---

**Common name:** Carnation
**Botanical name:** *Dianthus caryophyllus*
**Colors:** White, pink, red, yellow, violet and shades in between; also variegated
**Design:** Mass
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** 5-7 days

---

**Common name:** Cattleya orchid
**Botanical name:** *Cattleya cultivars*
**Colors:** Violet, lavender, pink, white, yellow
**Design:** Form
**Uses:** Corsages, funeral designs, arrangements—can be used in creating focal point because of distinctive shape and appearance
**Vase life:** 2-4 days in corsages when refrigerated between wearings; 3-7 days in arrangement with water

**Common name:** Chrysanthemum (Mum, typical spherical shape called Football Mum)
**Botanical name:** *Chrysanthemum morifolium*
**Colors:** White, yellow, bronze, lavender, shades of pink, red
**Design:** Mass
**Uses:** Corsages, home arrangements, funeral designs
**Vase life:** 7-14 days

**Common name:** Chrysanthemum, Pompon
**Botanical name:** *Chrysanthemum morifolium*
**Colors:** White, bronze, yellow, lavender, shades of pink, red
**Design:** Mass
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** About 10 days

**Common name:** Cymbidium
**Botanical name:** *Cymbidium x alexanderi*
**Colors:** White, yellow, pink, green, lavender
**Design:** Form
**Uses:** Corsages, funeral designs, arrangements
**Vase life:** 5-7 days in corsage, refrigerated; up to 2 weeks in water

**Common name:** Daffodil
**Botanical name:** *Narcissus pseudo-narcissus*
**Colors:** Yellow; may have orange or white bicolors
**Design:** Form
**Uses:** Arrangements, funeral designs
**Vase life:** 3-6 days depending on variety and environment

**Common name:** Delphinium
**Botanical name:** *Delphinium belladonna*
**Colors:** Blue, deep violet
**Design:** Line; form—if taken from central stem and used in clusters to wear or carry
**Uses:** Arrangements
**Vase life:** 3-8 days

---

**Common name:** Gladiola (Glad)
**Botanical name:** *Gladiolus x hortulanus varieties*
**Colors:** White, pink, salmon, yellow, orange, red, green
**Design:** Line
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** 1-2 weeks

---

**Common name:** Gardenia
**Botanical name:** *Gardenia jasminoides*
**Colors:** white
**Design:** Mass
**Uses:** Usually used alone in corsage; fragrant
**Vase life:** Up to 3 days in water; up to 2 wearings in corsages, if refrigerated between wearings

---

**Common name:** Gerbera Daisy
**Botanical name:** *Gerbera x jamesonii hybrida*
**Colors:** White, yellow, salmon, pink, orange, red
**Design:** Mass
**Uses:** Arrangements
**Vase life:** 3-8 days

---

**Common name:** Heather
**Botanical name:** *Erica species*
**Colors:** Rose, lavender
**Design:** Line
**Uses:** Arrangements
**Vase life:** 7-10 days fresh; up to one year dried

---

**Common name:** Iris
**Botanical name:** *Iris hybrids*
**Colors:** Blue, yellow, white, purple
**Design:** Form
**Uses:** Arrangements, corsages, funeral designs
**Vase life:** 3-7 days

**Common name:** Marguerite Daisy
**Botanical name:** *Chrysanthemum frutescens*
**Colors:** White, yellow
**Design:** Mass
**Uses:** Corsages, arrangements
**Vase life:** 3-8 days

**Common name:** Protea
**Botanical name:** *Protea species*
**Colors:** Wide range, including orange, pink, white, red, black
**Design:** Form
**Uses:** Arrangements—create focal points in design
**Vase life:** Up to 2 weeks; lasts up to one year dried

**Common name:** Ranunculus
**Botanical name:** *Ranunculus asiaticus*
**Colors:** Red, orange, yellow, pink, white
**Design:** Mass
**Uses:** Arrangements
**Vase life:** 3-5 days

**Common name:** Rose, Hybrid Tea
**Botanical name:** *Rosa hybrida (odorata)*
**Colors:** Red, yellow, pink, white, variegated
**Design:** Mass
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** 3-7 days, depending on variety, environmental factors

**Common name:** Rose, Floribunda or Sweetheart
**Botanical name:** *Rosa hybrida*
**Colors:** Red, yellow, pink, white, orange, variegated
**Design:** Mass
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** 3-8 days, depending on variety, environmental factors

---

**Common name:** Rubrum Lily
**Botanical name:** *Lilium speciosum "rubrum"*
**Colors:** White, pink or rose tint; spotted with red
**Design:** Form
**Uses:** Corsages, wedding bouquets
**Vase life:** 4-5 days

---

**Common name:** Snapdragon
**Botanical name:** *Antirrhinum majus*
**Colors:** Yellow, pink, white, red, lavender
**Design:** Line
**Uses:** Arrangements, funeral designs
**Vase life:** 5-8 days

---

**Common name:** Statice, seafoam, also Sea Lavender
**Botanical name:** *Limonium parezii*
**Colors:** White, yellow, purple
**Design:** Filler
**Uses:** Corsages, arrangements, funeral designs
**Vase life:** 1-2 weeks; long-lasting when dried

---

**Common name:** Stephanotis
**Botanical name:** *Stephanotis floribunda*
**Colors:** White
**Design:** Form
**Uses:** Corsages, wedding bouquets
**Vase life:** 3-4 days if kept refrigerated

---

**Common name:** Tulip
**Botanical name:** *Tulipa hybrida*
**Colors:** Wide range, including red, white, yellow, orange, purple
**Design:** Form
**Uses:** Arrangements, funeral designs
**Vase life** 3-6 days

*FOLIAGE*

**Common name:** Eucalyptus
**Botanical name:** *Eucalyptus cinerea*
**Colors:** Silver green
**Design:** Line; may also be used as filler
**Uses:** Arrangements
**Vase life:** 1-2 weeks; up to one year dried

---

**Common name:** Fern, Flat (also Oregon Fern)
**Botanical name:** *Polystichum munitum*
**Colors:** Glossy, medium green
**Design:** Line
**Uses:** Outline material for funeral arrangements, large arrangements
**Vase life:** 1-2 weeks

---

**Common name:** Fern, Leatherleaf or Baker's
**Botanical name:** *Dryopteris erythrosora*
**Colors:** Glossy medium green
**Design:** Filler, finish
**Uses:** Used as finish in arrangements, corsages, bouquets
**Vase life:** 1-2 weeks

---

**Common name:** Huckleberry
**Botanical name:** *Vaccinium ovatum*
**Colors:** Shiny medium green
**Design:** Filler
**Uses:** Corsages, arrangements
**Vase life:** Up to 3 weeks

---

**Common name:** Lemon Leaf or Salal
**Botanical name:** *Gaultheria shallon*
**Colors:** medium green, semi-gloss
**Design:** Filler
**Uses:** Massive outlines and backgrounds in floral design
**Vase life:** 1-3 weeks

**Common name:** Plumosa (also Asparagus Fern)
**Botanical name:** *Asparagus setaceus*
**Colors:** Dark green
**Design:** Filler
**Uses:** Corsages, wedding and funeral arrangements; adds feathery texture to arrangements
**Vase life:** 4-7 days

**Common name:** Scotch Broom
**Botanical name:** *Cytisus scoparius*
**Colors:** Dark green
**Design:** Line
**Uses:** Arrangements
**Vase life:** 1-3 weeks

**OBJECTIVE 10** **Recall uses, shapes, and examples of types of flowers and foliage used in floral design.**

**DIRECTIONS** Study the information in the chart on the following page; then answer the following questions. Write your answer in the space provided.

1. What is one of the uses of line flowers?

   ______________________________

2. Give two examples of flowers or foliage in the line category.

   a.______________________

   b.______________________

3. What is the shape of a mass flower?

   ______________________________

4. Give two examples of flowers or foliage in the mass category.

   a.______________________

   b.______________________

5. What is one of the uses of form flowers or foliage?

   ______________________________

6. Give two examples of flowers or foliage in the form category.

   a.______________________

   b.______________________

7. What is the shape of filler flowers or foliage?

   ______________________________

8. Give two examples of flowers or foliage in the form category.

   a.______________________

   b.______________________

| Type and uses | Shape | Flower, foliage examples |
|---|---|---|
| **LINE** | | |
| Used to form skeleton of arrangement<br>Used at edges of arrangements | Vertical, thin, tapered | Iris, roses, gladiolus, snapdragons, stock; branches of flowering shrubs such as forsythia; thistles, cattail, eucalyptus |

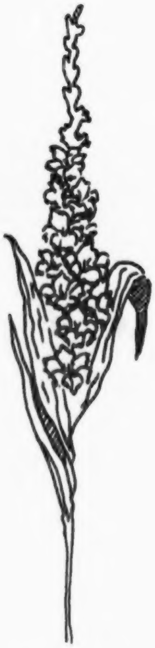


FIGURE 1

**MASS**

| | | |
|---|---|---|
| Used at center of arrangement | Rounded | Zinnia, marigold<br>carnation,<br>open tulip and rose,<br>yarrow, chrysanthemum,<br>gerbera, marguerite daisies |

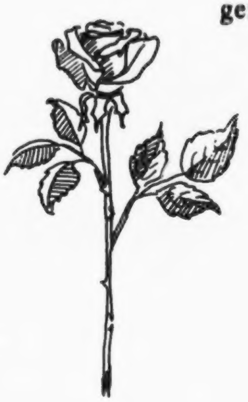


FIGURE 2

**FORM**

| | | |
|---|---|---|
| Creates unusual silhouettes<br>Rarely incorporated with other form flowers | Unusual shapes | Bird-of-paradise, lily,<br>orchid, antherium |

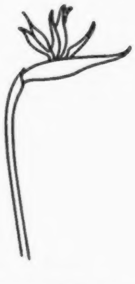


FIGURE 3

**FILLER**

| | | |
|---|---|---|
| Used to fill in between line and mass materials | Many blossoms or small leaves on single stem | Baby's breath, heather, statice, asparagus, fern, ivy, huckleberry |

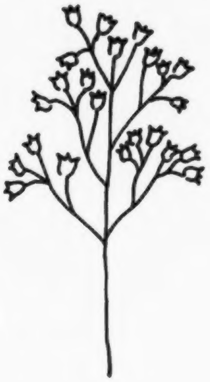


FIGURE 4

**ASSIGNMENT SHEET 2**

# INTRODUCTION TO FLORAL DESIGN

## VIII

**OBJECTIVE 11** **List characteristics of common cut flowers and foliage used in floral design.**

**DIRECTIONS** Your instructor will display 15 kinds of cut flowers and foliage described in Supplement 2. Write in the names of the flowers on the chart below and fill in the other information requested.

| Common Name | Colors | Design | Uses | Vase Life |
|---|---|---|---|---|
| | | | | |
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## ASSIGNMENT ANSWERS — INTRODUCTION TO FLORAL DESIGN — VIII

### ASSIGNMENT SHEET 1

1. Answer may include one of the following.

   a. Used to form skeleton of arrangement

   b. Used at edges of arrangement

2. Answer may include any two of the following: Iris, roses, gladiolis, snapdragons, stock, forsythia, thistle, cattail, eucalyptus

   NOTE: Instructor may want to review list of cut flowers and foliage for additional answers

3. Rounded

4. Answer may include any two of the following: Zinnia, marigold, carnation, open tulip and rose, yarrow, chrysanthemums, gerbera and marguerite daisies

   NOTE: Instructor may want to review list of cut flowers and foliage for additional answers

5. Answer may include one of the following.

   a. Create unusual silhouettes

   b. Rarely incorporated with other flowers

6. Answer may include any two of the following: Bird of paradise, lily, protea, orchid, anthurium

   NOTE: Instructor may want to review list of cut flowers and foliage for additional answers

7. Many blossom or small leaves on a single stem

8. Answer may include any two of the following: Baby's breath, heather, statice, asparagus fern, huckleberry, ivy

   NOTE: Instructor may want to review list of cut flowers and foliage for additional answers

### ASSIGNMENT SHEET 2

Answers will vary depending on the cut flowers and foliage used by the instructor.

**OBJECTIVE 12a** **Prepare and Care For Cut Flowers.**

**EQUIPMENT AND MATERIALS**

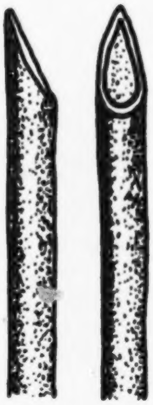
- Knife
- Cut flowers
- Storage container for flowers
- Floral shears
- Floral preservative
- Refrigeration unit

**PROCEDURE**

1. Clean storage container for flowers with a bleach solution or soap and rinse thoroughly.
2. Cut off the end of the stem about one-half inch from the bottom using a clean, sharp knife; cut the stem under water for best results.

   NOTE: A slant cut will make it easier to insert stem into floral foam. Most flowers last longer when cut with a knife rather than shears.

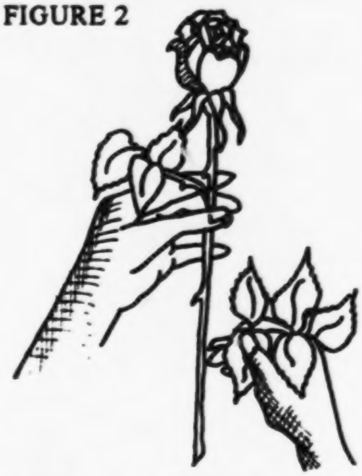
   FIGURE 1



3. Clean the flower by removing one-fourth to one-third of the lower foliage, including leaves and thorns; leaves should not be covered by water. (Figure 2)

NOTE: Cleaning helps reduce growth of bacteria caused by decaying foliage under water.

FIGURE 2



4. Put flowers in clean container filled one-fourth to one-third full of lukewarm water (100 degrees Fahrenheit) containing a floral preservative.

   NOTE: Follow manufacturer's instructions for preparing floral preservative. Never mix flowers or put fresh flowers in a container with older flowers. Daffodils can be deadly to other flowers because they secrete a poison in the water.

5. Make sure refrigeration unit is clean and free of old, damaged and diseased flowers, and free of foliage that may have dropped from other flowers.

   NOTE: Old flowers and foliage in a refrigerator emit ethylene gas, part of the natural process of aging flowers, and will cause younger flowers to mature more rapidly. Some modern cooling units have filters or scrubbers to remove the ethylene gas.

6. Place container of flowers in refrigeration unit; leave them in refrigerator for at least four hours.

   NOTE: Refrigeration should be set at about 40 degrees Fahrenheit.

7. Have instructor evaluate your work.

8. Clean up work area and put away equipment and materials.

**JOB SHEET 2**

## INTRODUCTION TO FLORAL DESIGN

## VIII

**OBJECTIVE 12b**

**Make a bud vase arrangement.**

**INTRODUCTION**

A bud vase is a tall, narrow container used to hold one flower or a small arrangement of flowers and foliage. The thin neck of the vase helps hold the plants in place and limits the amount of material that can be arranged in the container. Many different kinds of flowers can be used in a bud vase, including carnations, roses, daffodils, iris, statice, and baby's breath. The stem of the flower should be long enough to reach the bottom of the vase and still hold the flower head well above the rim of the container. Foliage can be added to the vase to complement the flowers and help hold them in place. Some examples are: boxwood, eucalyptus, huckleberry, scotch broom, and asparagus fern. Bows and other accessories may also be added. If fresh flowers and foliage are not available, dried or silk flowers can be used.

**EQUIPMENT AND MATERIALS**

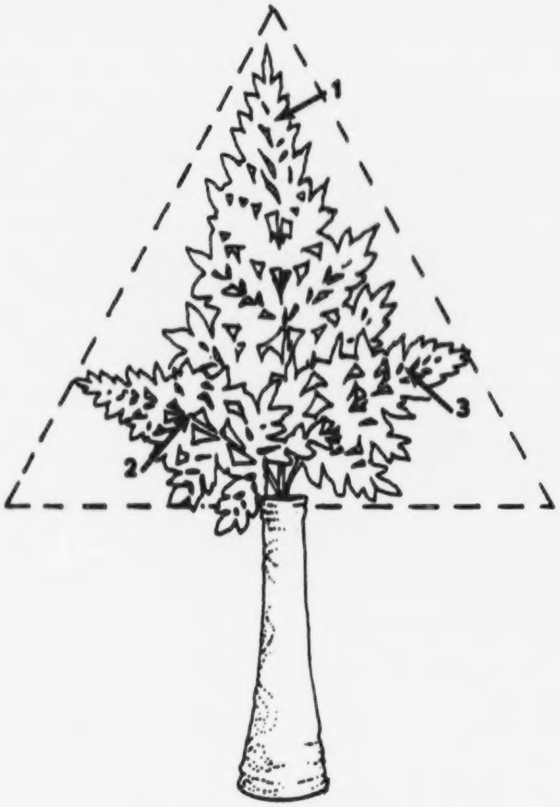
- Bud vase
- Three carnations
- Three pieces of leatherleaf fern
- Baby's breath
- Floral shears
- Bow with streamers, if desired
- Water
- Floral preservative

**PROCEDURE**

1. Clean vase with bleach solution or soap and rinse thoroughly.
2. Fill vase with water conditioned with floral preservative; do not overfill.
3. Wire carnations and foliage, if needed.

4. Place the fern foliage in the vase to form a triangular shape; the height of the arrangement should be 1 1/2 to 2 times the height of the container. (Figure 1)

FIGURE 1



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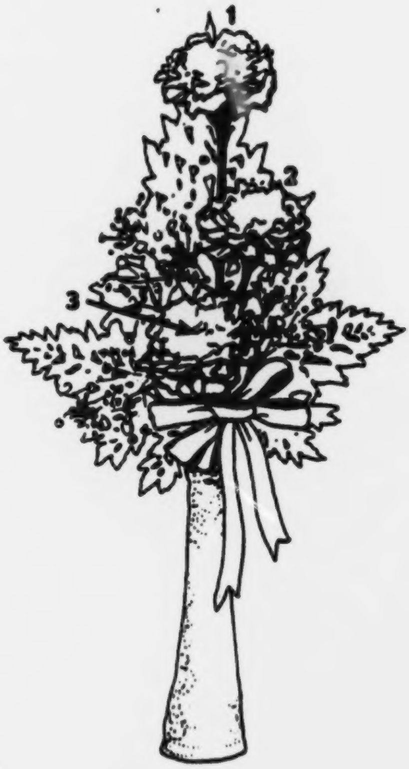
5. Place the carnations so that the blossoms are at different heights above the rim of the vase; one carnation should be at least a few inches above the rim of the container. The carnations should be in front of the foliage. (Figure 2)

FIGURE 2



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6. Add two or three pieces of baby's breath as filler; do not overcrowd the container.
7. Add bow, if desired, by inserting wires attached to the bow into container. (Figure 2)
8. Have instructor inspect your work.
9. Clean up work area and put away materials and equipment.

# JOB SHEET 3 — INTRODUCTION TO FLORAL DESIGN — VIII

**OBJECTIVE 12c**

**Wire a flower using the piercing method.**

**INTRODUCTION**

The piercing or insertion method, as it is also called, is used primarily on flowers such as carnations and roses, which have mass-type heads. The wire is used to replace the bulkiness of a stem. The wire also makes handling easier and keeps the flower in place when being worn. When using the insertion method on a long-stemmed flower to be used in an arrangement, the wire should be pushed into the base of the flower head and then wrapped around the stem.

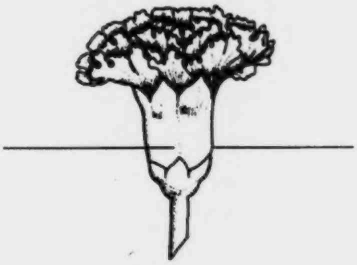
**EQUIPMENT AND MATERIALS**

- Floral wire (No. 24 to 32)
- Wire cutters, if needed
- Carnation from Job Sheet 2

**PROCEDURE**

1. Cut off the stem of the carnation about one finger width below the calyx (stub should be about 1/4 to 1/2 inch long.
2. Insert wire through the calyx. (Figure 1)

FIGURE 1



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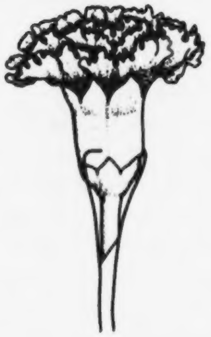
3. Bend down the wire ends so that they are parallel to the stem. (Figure 2)

FIGURE 2



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4. Have instructor evaluate your work.
5. Clean up work area and put away equipment and materials.

**OBJECTIVE 12d**

**Wire a flower using the hook wire method.**

**INTRODUCTION**

The hookwire method of wiring is used primarily for flowers with buttoned centers, such as daisies or chrysanthemums. Select the correct gauge wire for the job. If you are using flowers for an arrangement, do not cut off the stem; instead, after performing steps 2 through 4, twist the wire around the stem.

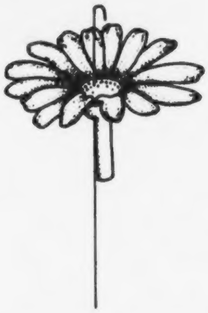
**EQUIPMENT AND MATERIALS**

- Floral wire (No. 24 to 32)
- Wire cutters, if needed
- Daisy or chrysanthemum

**PROCEDURE**

1. Cut off stem about one finger width below the calyx (leave a stub about 1/4 to 1/2 inch long).
2. Insert the wire through the base of the flower and into the center of the flower head.
3. Bend the end of the wire into a small hook. (Figure 1)

FIGURE 1



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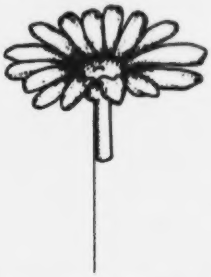
4. Pull the wire hook down into the flower head until it is barely visible. (Figure 2)

   **NOTE:** Be careful not to split the flower head when pulling down the hook.

   FIGURE 2

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5. Have instructor evaluate your work.

6. Clean up work area and put away tools and equipment.

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**JOB SHEET 5**

# INTRODUCTION TO FLORAL DESIGN

**OBJECTIVE 12e**

**Make a corsage bow.**

**INTRODUCTION**

There are many different ways to make a bow, depending on the design of a bouquet or arrangement and individual preference.

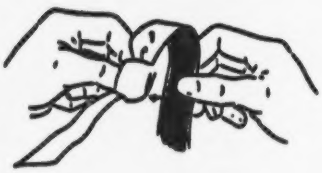
**EQUIPMENT AND MATERIALS**

- No. 3 satin ribbon (2 to 2 1/2 yards)
- 1 piece 26-gauge wire
- Ribbon shears

**PROCEDURE**

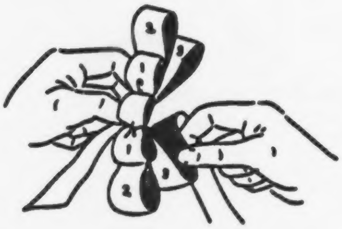
1. Hold the ribbon between your thumb and index finger; make a small loop and gather it under the thumb. Leave about 2 inches on the ribbon end. (Figure 1)

FIGURE 1



2. Make a pair of loops below the first small loop; twist the loops where you are pinching them so the shiny side of the ribbon is always on the outside.
3. Make at least four pairs of loops of varying sizes. (Figure 2)

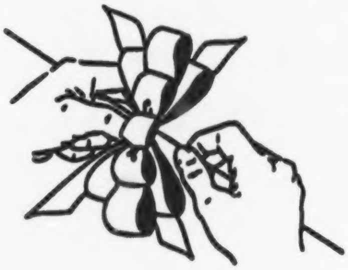
FIGURE 2



4. Cut ribbon the same length as the first piece.

5. Put the piece of 26-gauge wire through the small loop and pull it through until the center of the wire is at your thumb and finger holding the ribbon. (Figure 3)

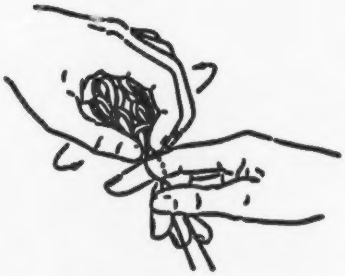
FIGURE 3



6. Bend the wire into a hair-pin shape; then pull on the ribbon loops with one hand while using the other hand to twist the wire together about 2 to 3 times. (Figure 4)

NOTE: Make sure wire is tight or loops will come undone.

FIGURE 4



7. Have instructor inspect your work.

8. Clean up work area and put away materials and equipment.

**JOB SHEET 6**

# INTRODUCTION TO FLORAL DESIGN

# VIII

**OBJECTIVE 12f**

**Make a boutonniere.**

**INTRODUCTION**

The boutonniere is made to be worn in the buttonhole of a man's jacket lapel. It can be made from a single flower or a single flower with a piece of foliage such as fern or babys' breath added. The design should be simple.

**EQUIPMENT AND MATERIALS**

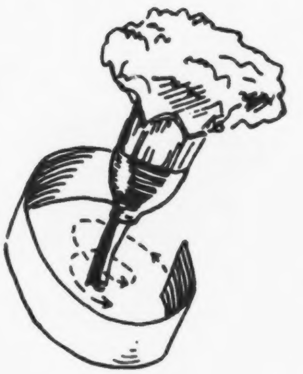
- Wired carnation from Job Sheet 3
- Fern or babys' breath
- Shears
- Floral tape
- Boutonniere pin
- Box or bag

**PROCEDURE**

1. Wrap carnation from Job Sheet 3 with floral tape by starting the tape near the flower head from behind; hold and rotate the stem in one hand while winding the tape around the stem with the other hand (Figure 1)

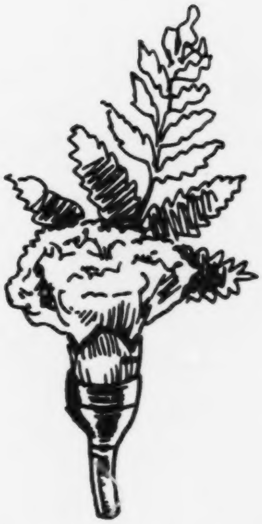
   **NOTE:** Wrap the tape tightly for best results.

   FIGURE 1



2. Place a small piece of foliage behind the flower, if desired; wrap the stems together with floral tape (Figure 2)

FIGURE 2



3. Bend the base of the stem into a small circle, or leave the stem straight, but shorten by cutting with a pair of shears.
4. Insert boutonniere pin through the base of the calyx.
5. Package and refrigerate flower.
6. Have instructor evaluate your work.
8. Clean up work area and put away equipment and materials.

**OBJECTIVE 12g**

**Make a two-flower corsage.**

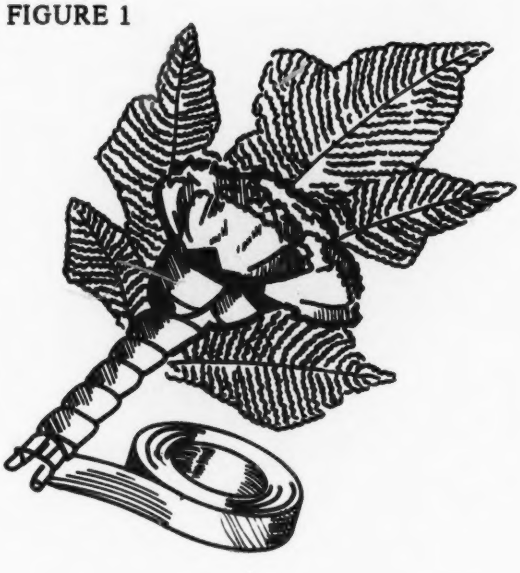
**EQUIPMENT AND MATERIALS**

- Two carnations
- Shears
- Satin corsage bow (from Job Sheet 5)
- Floral tape
- Floral wire
- Corsage pin
- Foliage or tufted netting
- Plastic bag or box

**PROCEDURE**

1. Wire carnations according to instructions in Job Sheet 3.
2. Wrap carnations according to Step 1 in Job Sheet 6.
3. Place foliage or tufted netting behind each flower head.
4. Join the two carnations together with wire and tape. (Figure 1)

FIGURE 1



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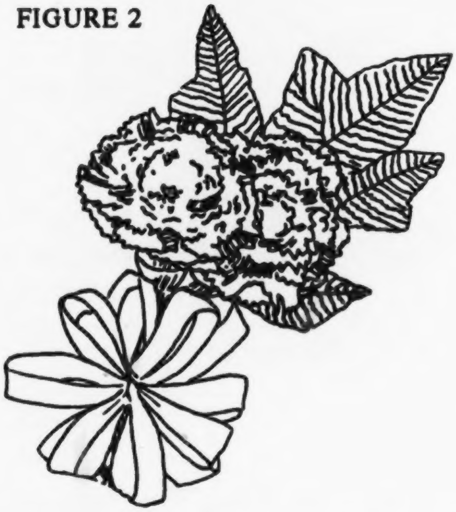
5. Attach corsage bow from Job Sheet 5 between the flowers; tape any areas that need to be concealed. (Figure 2)

FIGURE 2



6. Put a corsage pin into one of the flowers at the base of the calyx.
7. Place the corsage into a plastic bag or box; place in refrigerator.
8. Have instructor evaluate your work.
9. Clean up work area and put away equipment and materials.

**JOB SHEET 8**

# INTRODUCTION TO FLORAL DESIGN

**VIII**

**OBJECTIVE 12h**

**Create a symmetrical arrangement.**

**INTRODUCTION**

A symmetrical arrangement is one with equal amounts of flowers and foliage on either side of an axis. In this job sheet, the arrangement will be triangular-shaped. Triangular arrangements are often one-sided and generally viewed from the front. Symmetrical arrangements can also be rounded, oval, fan-shaped, or mounded. This triangular arrangement is made with one type of flower, but secondary flowers and filler flowers can also be used. If you are using one kind of flower, try form and mass flowers such as carnations, chrysanthemums, anthurium, gerbera daisy, iris, or roses. The foliage forms the background and reinforces the line of the arrangement.

**EQUIPMENT AND MATERIALS**

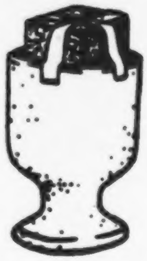
- Knife
- Floral shears
- Wire
- Wire cutters
- Container
- Floral foam
- Waterproof tape
- Flowers (Roses or carnations)
- Foliage (Ferns)

**PROCEDURE**

1. Select the proper container for the arrangement you have in mind.
2. Clean container by washing it with a bleach solution or soapy water; rinse thoroughly.
3. Cut floral foam to fit the container; soak foam in water with floral preservative.

4. Place foam in container and tape with waterproof tape; foam should rise about 1 1/2 inches above rim of container. (Figure 1)

FIGURE 1



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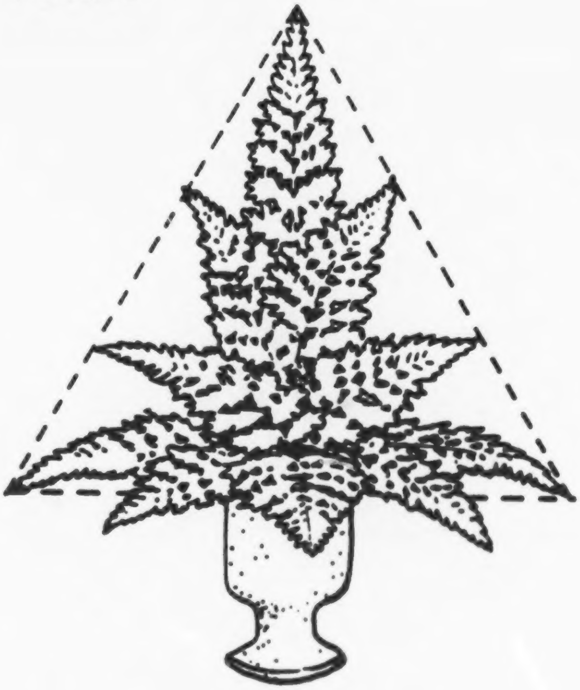
5. Fill container with water, making sure the water level is no more than one inch from the top of the container.

6. Wire flowers, if support is needed.

   NOTE: Flowers can be wired using procedures outlined in Job Sheets 3 and 4; HOWEVER, the stem should not be removed and wire should be wound down around the stem before taping.

7. **Establish the height of the arrangement using the foliage; the height of the foliage should be 1 1/2 to 2 times the size of the container. (Figure 2)**

FIGURE 2



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8. **Form the width of the arrangement with shorter pieces of foliage.**
9. **Add depth to the arrangement by placing short pieces into the foam above the rim of the container and aiming them toward you.**
10. **Fill in to hide foam, placing foliage so that it appears to radiate from a central point in the foam; remember not to fill in too densely since flowers will be added.**

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11. Repeat steps 7 through 9 with flowers (roses or carnations) to create height, width and depth; fill in arrangement, but do not crowd flowers. (Figures 3 and 4)

    **NOTE:** Longer pieces of foliage should extend beyond the flowers for the framework, but other foliage should be behind the flowers.

FIGURE 3

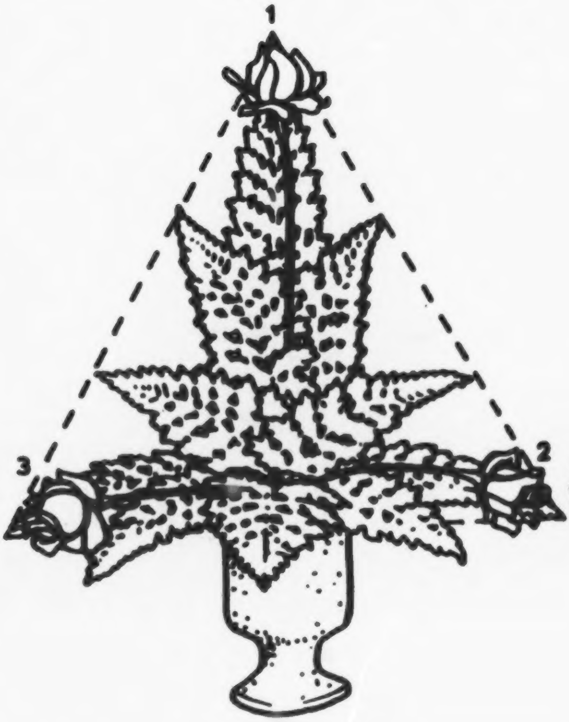
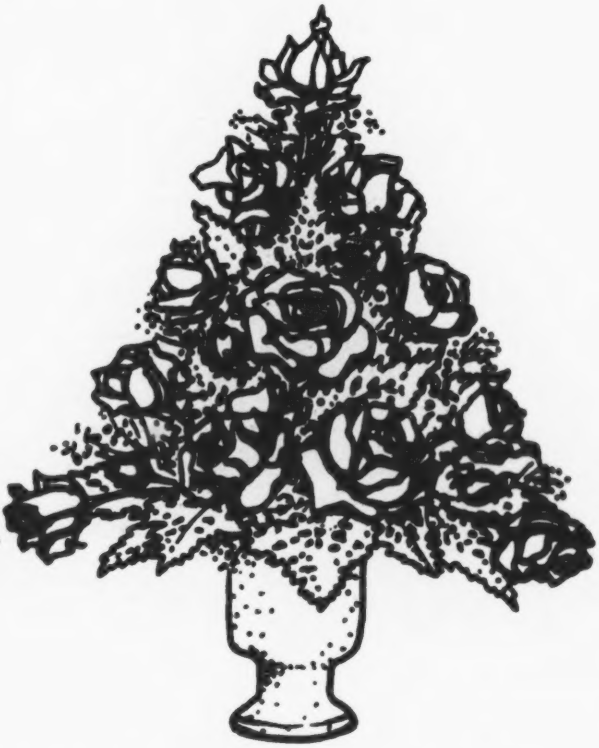


FIGURE 4



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12. Have instructor inspect your work.

13. Clean up work area and put away equipment and materials.

# INTRODUCTION TO FLORAL DESIGN

**OBJECTIVE 12I**

**Create an asymmetrical arrangement.**

**INTRODUCTION**

An asymmetrical arrangement is one that is basically a right angle form. The weight on either side of the center line is not the same. Right triangle arrangements can be right-sided or left-sided and can be used in pairs to complement each other. The arrangement can be created using primary flowers to create a focal point, secondary flowers to give unity and interest, and filler flowers. Examples of primary flowers are carnations, chrysanthemums, gerbera daisy, anthurium, iris, and roses. Secondary flowers such as asters, alstroemeria, miniature carnations, cornflowers, pompon mums, and daisies can be used. Examples of filler are yarrow, heather, statice, and baby's breath.

**MATERIALS AND EQUIPMENT**

- Knife
- Floral shears
- Wire
- Wire cutters
- Low container
- Foam
- Waterproof tape
- Flowers (Carnations)
- Foliage (Ferns)

**PROCEDURE**

1. Select the proper container for the arrangement you have in mind.
2. Clean container by washing it with a bleach solution or soapy water; rinse thoroughly.
3. Cut floral foam to fit the container; soak foam in water with floral preservative.
4. Place foam in container and tape with waterproof tape; foam should rise about 1 1/2 inches above rim of container.

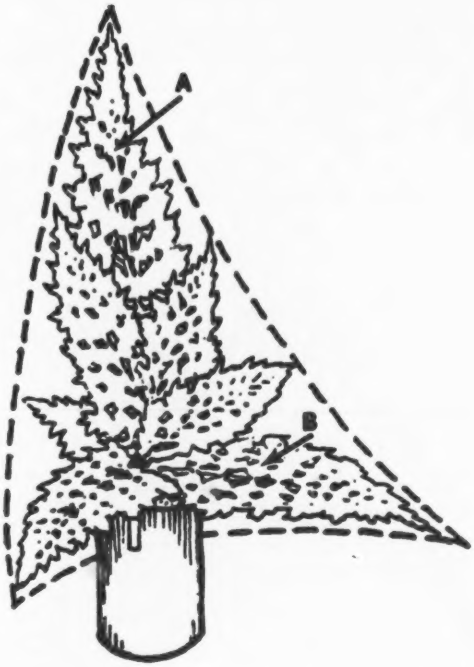
5. Fill container with water, making sure the water level is no more than one inch from the top of the container.

6. Wire flowers, if needed.

   NOTE: Flowers can be wired using procedures outlined in Job Sheets 3 and 4; HOWEVER, the stem should not be removed and wire should be wound down around the stem before taping.

7. Establish the height and width of the arrangement by placing the foliage in an L-shape. (Figure 1)

   FIGURE 1



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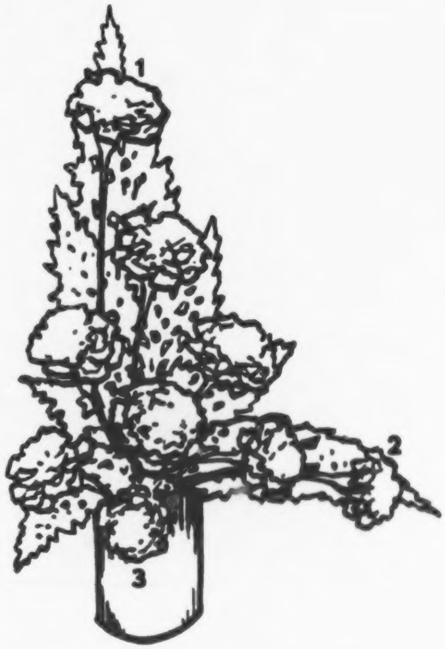
8. Place some foliage to the left of the arrangement to give it a less rigid look.

9. Place carnations to make an L-shape in front of the foliage. (Figure 2)

10. Connect the top left point with the lower right point by spacing carnations between the two points, angling the flowers slightly forward. (Figure 2)

    **NOTE:** The focal point runs along the base of the arrangement. Flowers in this area should be larger or showier.

    FIGURE 2



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11. Fill in with more carnations.

12. Add foliage such as fern branches to cover the foam and tape.

13. Add filler such as baby's breath, if desired. (Figure 3)

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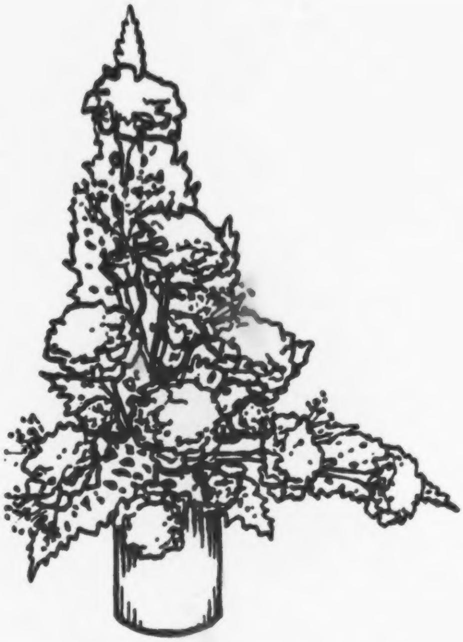
FIGURE 3



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14. Have instructor evaluate your work.

15. Clean up work area and put away equipment and materials.

**JOB SHEET 10**

# INTRODUCTION TO FLORAL DESIGN

**III**

**OBJECTIVE 12j**

**Make a wreath.**

**INTRODUCTION**

Wreaths are often used during the holidays to decorate doors or walls. The boughs can be attached to a coat hanger or a ready-made circular form of wood, straw, wire, or plastic foam.

**EQUIPMENT AND MATERIALS**

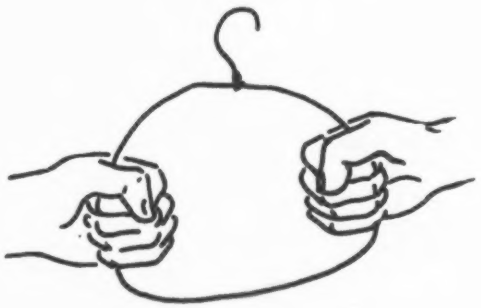
- Coat hanger or circular form
- Wire cutters
- Floral wire (Spool)
- Boughs of fir trees
- Gloves, if needed

  NOTE: Branches of other evergreens such as cedars or junipers can be used.
- Floral wire
- Bow and decorations

**PROCEDURE**

1. Shape the coat hanger into a circle. (Figure 1)

FIGURE 1



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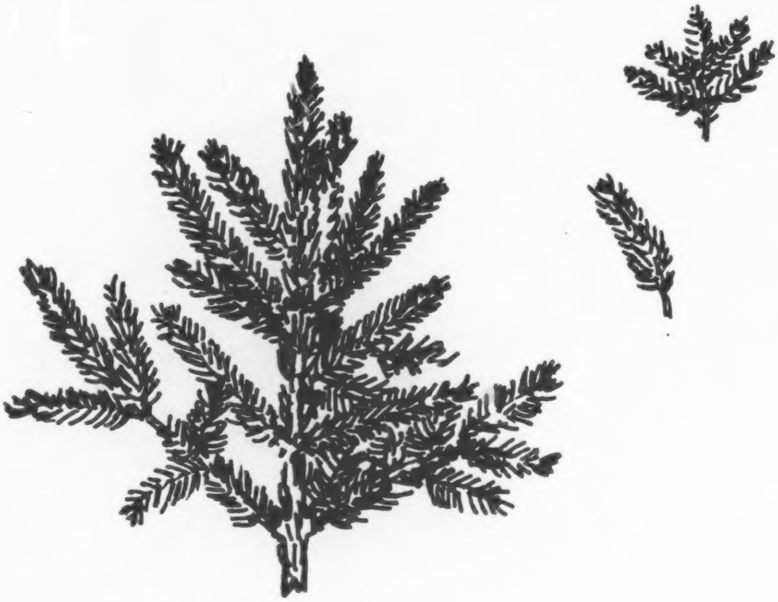
2. Cut the fir boughs into piece about 4 to 6 inches long. (Figure 2)

FIGURE 2



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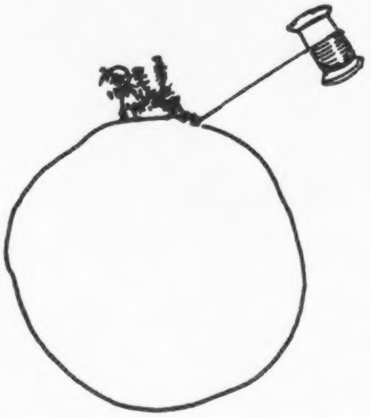
3. Put some cuttings in a group and wrap the wire tightly around the stems several times. (Figure 3)

FIGURE 3



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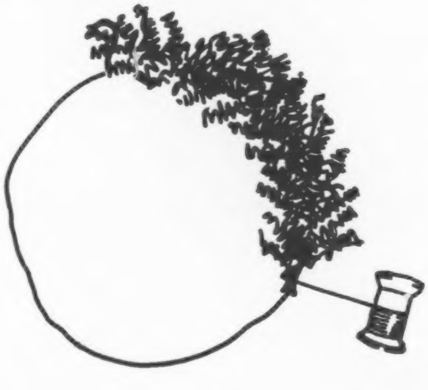
4. Do the same thing with another group of cuttings. The second group should overlap the first group.
5. Go all the way around, using the greens and wrapping tightly with the wire. (Figure 4)

FIGURE 4



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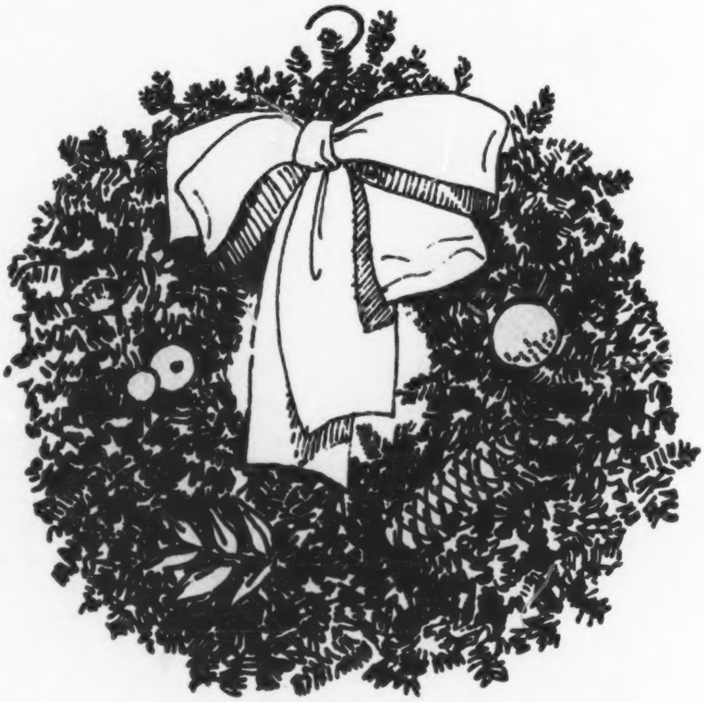
6. Decorate as desired. (Figure 5)

FIGURE 5



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7. Have instructor inspect your work.
8. Clean up work area and put away equipment and materials.

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## INTRODUCTION TO FLORAL DESIGN

**JOB SHEET 1**

**Prepare and care for cut flowers.**

Student's name________________________ Date __________

Evaluator's name________________________ Attempt no._____

Instructions: When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

### PROCESS EVALUATION

Evaluator note: Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Cleaned storage container. | _____ | _____ |
| 2. Cut off stem about 1/2 inch from bottom. | _____ | _____ |
| 3. Cleaned flower by removing 1/4 to 1/3 of lower foliage. | _____ | _____ |
| 4. Put flowers in clean container filled 1/4 to 1/3 full of lukewarm water containing floral preservative. | _____ | _____ |
| 5. Made sure refrigeration unit was clean. | _____ | _____ |
| 6. Placed flowers in unit. | _____ | _____ |
| 7. Used proper tools correctly. | _____ | _____ |
| 8. Performed steps in a timely manner. | _____ | _____ |
| 9. Practiced safety rules throughout procedure. | _____ | _____ |
| 10. Provided satisfactory responses to questions asked. | _____ | _____ |
| 11. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Cut on flower stem | 4 | 3 | 2 | 1 |
| Removed foliage on stem | 4 | 3 | 2 | 1 |
| Checked water depth | 4 | 3 | 2 | 1 |
| Checked water temperature | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

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## JOB SHEET 2

**Make a bud vase arrangement.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

## PROCESS EVALUATION

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Cleaned vase. | ____ | ____ |
| 2. Filled vase with water containing floral preservative. | ____ | ____ |
| 3. Wired carnations and foliage, if needed. | ____ | ____ |
| 4. Placed ferns in vase to form triangular shape; height of arrangement was 1 1/2 to 2 times the height of the container. | ____ | ____ |
| 5. Placed carnations at different heights above rim of vase; one carnation was at least a few inches above the rim of the container. | ____ | ____ |
| 6. Added baby's breath as filler. | ____ | ____ |
| 7. Added bow, if desired. | ____ | ____ |
| 8. Practiced safety rules throughout procedure. | ____ | ____ |
| 9. Performed steps in a timely manner. | ____ | ____ |
| 10. Provided satisfactory responses to questions asked | ____ | ____ |
| 11. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Checked shape of arrangement | 4 | 3 | 2 | 1 |
| Checked height of flowers in arrangement | 4 | 3 | 2 | 1 |
| Checked water depth | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 3** | **INTRODUCTION TO FLORAL DESIGN** | **VIII**

**JOB SHEET 3**

**Wire a flower using the piercing method.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Cut off stem of carnation about one finger width below calyx. | ____ | ____ |
| 2. Inserted wire through calyx. | ____ | ____ |
| 3. Bent down wire parallel to stem. | ____ | ____ |
| 4. Used proper tools correctly. | ____ | ____ |
| 5. Practiced safety rules throughout procedure. | | |
| 6. Performed steps in a timely manner. | ____ | ____ |
| 7. Provided satisfactory responses to questions asked. | ____ | ____ |
| 8. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Cut on stem | 4 | 3 | 2 | 1 |
| Checked placement of wire | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**JOB SHEET 4**

**Wire a flower using the hookwire method.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Cut off stem one finger width below calyx. | ____ | ____ |
| 2. Inserted wire through base of flower into center of flower head. | ____ | ____ |
| 3. Bent end of wire into small hook. | ____ | ____ |
| 4. Pulled wire hook into flower head until barely visible. | ____ | ____ |
| 5. Used proper tools correctly. | ____ | ____ |
| 6. Practiced safety rules throughout procedure. | ____ | ____ |
| 7. Performed steps in a timely manner. | ____ | ____ |
| 8. Provided satisfactory responses to questions asked. | ____ | ____ |
| 9. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Cut on stem | 4 | 3 | 2 | 1 |
| Placement of wire | 4 | 3 | 2 | 1 |
| Checked appearance of wire in flower head | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

## PRACTICAL TEST 5 — INTRODUCTION TO FLORAL DESIGN — VIII

**JOB SHEET 5**

**Make a corsage bow.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Held ribbon between thumb and index finger; made small loop. | ____ | ____ |
| 2. Left 2 inches on ribbon end. | ____ | ____ |
| 3. Made a pair of loops below first loop and made sure shiny side of ribbon is on outside. | ____ | ____ |
| 4. Made at least 4 pairs of loops of varying sizes. | ____ | ____ |
| 5. Cut ribbon same length as first piece. | ____ | ____ |
| 6. Put wire through first small loop. | ____ | ____ |
| 7. Bent wire into hairpin shape and twisted wire together. | ____ | ____ |
| 8. Used proper tools correctly. | ____ | ____ |
| 9. Practiced safety rules throughout procedure. | ____ | ____ |
| 10. Performed steps in a timely manner. | ____ | ____ |
| 11. Provided satisfactory responses to questions asked. | ____ | ____ |
| 12. Put away tools and cleaned work area. | | |

## EVALUATOR'S COMMENTS

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Construction of loops | 4 | 3 | 2 | 1 |
| Placement of wire | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

## PRACTICAL TEST 6 | INTRODUCTION TO FLORAL DESIGN VIII

**JOB SHEET 6**

**Make a boutonniere.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Wrapped carnation with floral tape. | _____ | _____ |
| 2. Placed small piece of foliage behind flower, if desired. | _____ | _____ |
| 3. Wrapped stems together with floral tape. | _____ | _____ |
| 4. Bent base of stem into small circle or shortened it using shears. | _____ | _____ |
| 5. Inserted boutonniere pin through base of calyx. | _____ | _____ |
| 6. Packaged and refrigerated flower. | _____ | _____ |
| 7. Practiced safety rules throughout. procedure. | _____ | _____ |
| 8. Performed steps in a timely manner. | _____ | _____ |
| 9. Provided satisfactory responses to questions asked. | _____ | _____ |
| 10. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Application of floral tape | 4 | 3 | 2 | 1 |
| Placement of foliage | 4 | 3 | 2 | 1 |
| Placement of pin | 4 | 3 | 2 | 1 |
| Packaging of boutonniere | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

## PRACTICAL TEST 7 — INTRODUCTION TO FLORAL DESIGN — VIII

**JOB SHEET 7**

**Make a two-flower corsage.**

Student's name ____________________ Date ________

Evaluator's name ____________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Wired carnations properly. | ____ | ____ |
| 2. Wrapped carnations properly. | ____ | ____ |
| 3. Placed foliage or netting behind each flower head. | ____ | ____ |
| 4. Joined two carnations with wire and tape. | ____ | ____ |
| 5. Attached corsage between flowers. | ____ | ____ |
| 6. Put corsage pin into one flower at base of calyx. | ____ | ____ |
| 7. Placed corsage into plastic bag or box and put into refrigerator. | ____ | ____ |
| 8. Practiced safety rules throughout. | ____ | ____ |
| 9. Performed steps in a timely manner. | ____ | ____ |
| 10. Provided satisfactory respnses to questions asked. | ____ | ____ |
| 11. Put away tools and cleaned work area. | ____ | ____ |

## EVALUATOR'S COMMENTS

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Placement of wire | 4 | 3 | 2 | 1 |
| Placement of floral tape | 4 | 3 | 2 | 1 |
| Placement of foliage or netting | 4 | 3 | 2 | 1 |
| Packaging of corsage | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

## JOB SHEET 8

**Create a symmetrical arrangement.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

## PROCESS EVALUATION

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected proper container. | ____ | ____ |
| 2. Cleaned container. | ____ | ____ |
| 3. Cut floral foam to fit container and soaked it in water with preservative. | ____ | ____ |
| 4. Placed foam in container and taped it; foam was about 1 1/2 inches above rim of container. | ____ | ____ |
| 5. Filled container with water, making sure water was one inch below top of container. | ____ | ____ |
| 6. Wired flowers, if needed. | ____ | ____ |
| 7. Established height of arrangement with foliage; height was 1 1/2 to 2 times the size of container. | ____ | ____ |
| 8. Formed width of arrangement with shorter pieces of foliage. | ____ | ____ |
| 9. Added depth using short pieces. | ____ | ____ |
| 10. Filled in to hide foam. | ____ | ____ |
| 11. Repeated steps with flowers to create height, width, and depth. | ____ | ____ |
| 12. Did not crowd flowers. | ____ | ____ |
| 13. Practiced safety rules throughout. procedure. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 14. Performed steps in a timely manner. | _____ | _____ |
| 15. Provided satisfactory responses to questions asked. | _____ | _____ |
| 16. Put away tools and cleaned work area | _____ | _____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Container selection | 4 | 3 | 2 | 1 |
| Placement and taping of foam | 4 | 3 | 2 | 1 |
| Flower wiring | 4 | 3 | 2 | 1 |
| Symmetry of arrangement | 4 | 3 | 2 | 1 |
| Color scheme (if applicable) | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**PRACTICAL TEST 9**

# INTRODUCTION TO FLORAL DESIGN VIII

**JOB SHEET 9**

**Create an asymmetrical arrangement.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected proper container. | _____ | _____ |
| 2. Cleaned container. | _____ | _____ |
| 3. Cut floral foam to fit container and soaked it in water with floral preservative. | _____ | _____ |
| 4. Taped foam into container; made sure foam was 1 1/2 inches above rim. | _____ | _____ |
| 5. Filled container with water; level was 1 inch below rim. | _____ | _____ |
| 6. Wired flowers, if needed. | _____ | _____ |
| 7. Established height and width of arrangement by placing foliage in an L-shape. | _____ | _____ |
| 8. Placed some foliage to the left of the arrangement. | _____ | _____ |
| 9. Placed carnations to make L-shape in front of foliage. | _____ | _____ |
| 10. Connected top left with lower right points using carnations; angled flowers slightly forward. | _____ | _____ |
| 11. Filled in with more carnations. | _____ | _____ |
| 12. Added foliage to cover foam and tape. | | |
| 13. Added filler, if desired. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 14. Practiced safety rules throughout procedure. | ____ | ____ |
| 15. Performed steps in a timely manner. | ____ | ____ |
| 16. Provided satisfactory responses to questions asked. | ____ | ____ |
| 17. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Container selection | 4 | 3 | 2 | 1 |
| Placement and taping of foam | 4 | 3 | 2 | 1 |
| Wiring of flowers | 4 | 3 | 2 | 1 |
| Asymmetrical shape | 4 | 3 | 2 | 1 |
| Color scheme (if applicable) | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**PRACTICAL TEST 10**

## INTRODUCTION TO FLORAL DESIGN

## VIII

**JOB SHEET 10**

**Make a wreath.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Shaped coat hanger into a circle. | | |
| 2. Cut boughs into 4- to 6-inch pieces. | | |
| 3. Put cuttings in a small group and wrapped wire around stem several times. | | |
| 4. Continued to wire cuttings onto frame, overlapping previous cuttings. | | |
| 5. Decorated wreath, if desired. | | |
| 6. Practiced safety rules throughout procedure. | | |
| 7. Performed steps in a timely manner. | | |
| 8. Provided satisfactory responses to questions asked. | | |
| 9. Put away tools and cleaned work area. | | |

**EVALUATOR'S COMMENTS**

### PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Shape of wreath | 4 | 3 | 2 | 1 |
| Size of boughs | 4 | 3 | 2 | 1 |
| Placement of boughs | 4 | 3 | 2 | 1 |
| Appearance of wreath decor (if applicable) | 4 | 3 | 2 | 1 |

### EVALUATOR'S COMMENTS

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - **Skilled**—Can perform job with no additional training

3 - **Moderately skilled**—Has performed job during training program; limited additional training may be required

2 - **Limited skill**—Has performed job during training program; additional training is required to develop skill

1 - **Unskilled**—Is familiar with process; but is unable to perform job

**WRITTEN TEST**

# INTRODUCTION TO FLORAL DESIGN

# VIII

**OBJECTIVE 1**

**Match terms associated with floral design to their correct definitions.** Write the correct letters in the blanks. (Questions are continued on following page.)

___ 1. A flower or small grouping of flowers worn by a man, usually on a jacket lapel

___ 2. A corsage made to resemble a camellia flower; usually constructed from gladiolus petals

___ 3. Items used to support a floral design, such as a candle or fruit

___ 4. An arrangement that is basically a right angle form; the weight on either side of the center line is not the same

___ 5. An arrangement that has its spine or main line of weight through the center with equal weight on either side of that center line

___ 6. A design element that uses materials to form an outline or skeleton

___ 7. The name by which a plant is generally known

___ 8. The sepals of a flower; may form a cone around the petals

___ 9. Thickness of wire

___ 10. A flower or grouping of flowers, net, bow, or other accessories to be worn by a woman

___ 11. A type of flower used to add interest and complete a design

a. Intensity
b. Wire gauge
c. Floral design
d. Corsage
e. Symmetrical
f. Sphere
g. Boutonniere
h. Base
i. Calyx
j. Common name
k. Line
l. Diagonal
m. Accessories
n. Mass
o. Azalea
p. Glamellia
q. Foundation
r. Filler
s. Asymmetrical
t. Bachelor button

___12. The art of creating arrangements from flowers and foliage

___13. Substance that holds the plant materials in place

___14. A closely spaced grouping of flowers in an arrangement

**OBJECTIVE 2**

**Match tools used in floral design to their correct uses.** Circle the correct answer.

1. A knife is used to

   a. Cut medium-sized stems of flowers and foliage

   b. Cut ribbon

   c. Cut thin-stemmed flowers and foliage

   d. Cut wire and plastic or silk flowers

2. Ribbon shears are used to

   a. Attach bows to an arrangement

   b. Cut floral foam

   c. Cut ribbon or trim foliage

   d. Cut thin-stemmed flowers and foliage

3. Wire cutters are used to

   a. Cut ribbon or trim foliage

   b. Cut thin-stemmed flowers and foliage

   c. Cut medium-sized stems of flowers and foliage

   d. Cut wire and silk or plastic flowers

4. A glue gun is used to

   a. Secure foam into containers, add trim

   b. Secure floral tape to a wired stem

   c. Secure flower heads to stems

   d. Secure fresh flowers in arrangement

5. Floral shears are used to

   a. Cut ribbon

   b. Cut floral foam

   c. Cut thin-stemmed flowers and foliage

   d. Cut medium-sized stems of flowers and foliage

**OBJECTIVE 3**

**Describe common materials used in floral design.** Write the correct answers in the blanks.

Floral foam— ______________________________

________________________________________

________________________________________

Floral tape — ______________________________

________________________________________

________________________________________

Waterproof tape — ____________________________

________________________________________

________________________________________

Ribbon — _________________________________

________________________________________

Floral preservative — __________________________

________________________________________

________________________________________

Floral wire — ______________________________

________________________________________

________________________________________

Wire pick — _______________________________

________________________________________

________________________________________

Wire netting — ______________________________

______________________________________________

______________________________________________

Floral containers — ___________________________

______________________________________________

______________________________________________

**OBJECTIVE 4**

**Match common wire sizes to their correct uses.** Write the correct letters in the blanks.

____1. Used to support larger flower stems or heavy flowers such as gladioli, lilies, snapdragons

____2. Used for delicate corsage work

____3. Used to replace flower stems in corsages, wedding bouquets

____4. Used to support flowers such as roses, carnations, chrysanthemums

a. 38-40 gauge

b. 32-36 gauge

c. 28-30 gauge

d. 24-26 gauge

e. 20-22 gauge

f. 16-20 gauge

**OBJECTIVE 5**

**Match common ribbon sizes to their correct definitions.** Circle the correct answer.

1. No. 3 ribbon is used
   a. For funeral arrangements
   b. For large floral arrangements
   c. For corsages and bud vases
   d. For aisle decoration at weddings
2. No. 9 ribbon is used
   a. To decorate blooming plants, green plants, and rose arrangements
   b. For corsages and bud vases
   c. For funeral arrangements
   d. For aisle decoration at weddings

3. No. 40 ribbon is used

    a. For floral hair pieces

    b. For wedding accessories and funeral arrangements

    c. For corsages and bud vases

    d. To decorate blooming plants and rose arrangements

**OBJECTIVE 6**

**Describe uses for common types of floral containers.** Write the correct answers in the blanks.

Tall vase— ____________________

Urn — ____________________

Deep bowls— ____________________

Pedestal— ____________________

Baskets— ____________________

Low bowls or oblong trays— ____________________

____________________

Goblet — ____________________

**OBJECTIVE 7**

**Select from a list guidelines for using color in floral design.** Write an "X" in the blank before each correct answer.

___ 1. Place darker colored flowers lower and deeper into arrangement

___ 2. Select color contrasts to match the mood of the occasion

___ 3. Use bright colors sparingly so as not to dominate the arrangement

___ 4. Don't create confusion by using too many different colors

___ 5. Use as many colors as possible in an arrangement

___ 6. Use bright colors generously to draw attention to the arrangement

___ 7. Repeat colors in a design

___ 8. Allow one color to dominate the arrangement

____9. Place darker colored flowers higher in the arrangement and toward the edges

**OBJECTIVE 8**

**Define the basic principles of design.** Write the correct answers in the blanks.

Rhythm—____________________

____________________

____________________

Focal point — ____________________

____________________

Balance— ____________________

____________________

____________________

Proportion — ____________________

____________________

____________________

Harmony — ____________________

____________________

____________________

**OBJECTIVE 9**

**Identify basic types of floral arrangements.** Write the correct answers in the blanks.

FIGURE 1

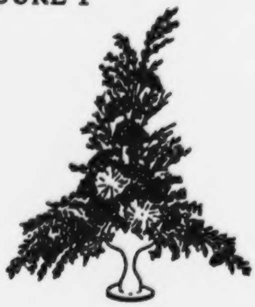
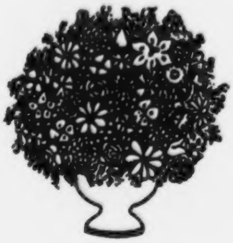


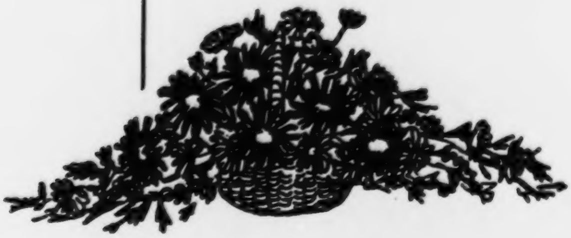
FIGURE 2



____________________ 1.

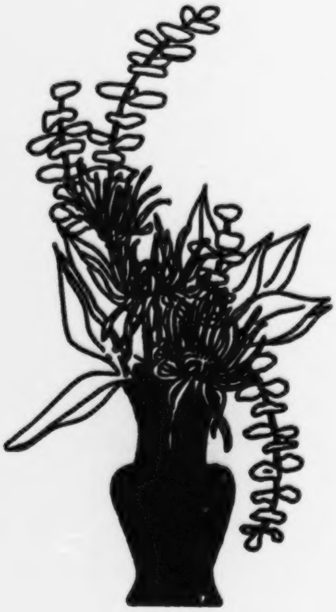
2. ____________________

FIGURE 3



_________________________ 3.

FIGURE 4



4. _________________________

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FIGURE 5

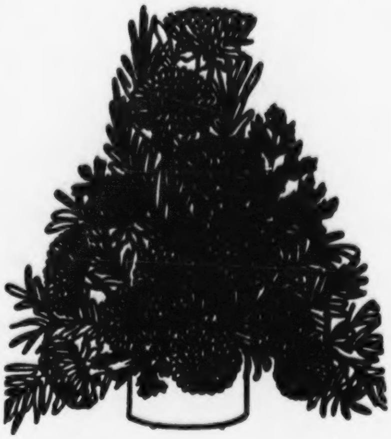
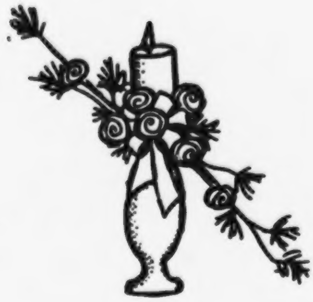


FIGURE 6



______________________ 5.

6. ______________________

FIGURE 7

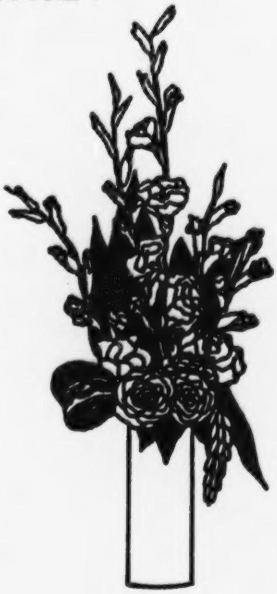
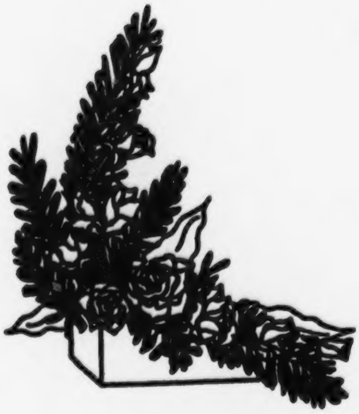


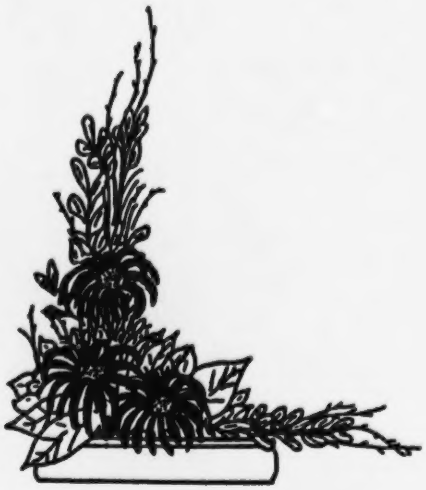
FIGURE 8



______________________ 7.

8 ______________________

FIGURE 9



________________________ 9.

| | | |
|---|---|---|
| **NOTICE** | The following assignments sheets and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor. | |
| **OBJECTIVE 10** | **Recall information on flower or foliage shapes, uses, and examples.** | SCORE _______ |
| **OBJECTIVE 11** | **Identify common cut flowers and foliage shapes, uses, and examples.** | SCORE _______ |
| **OBJECTIVE 12** | **Demonstrate ability to** | |
| | **a. Prepare and care for cut flowers.** | RATING ______ |
| | **b. Make a bud vase arrangement.** | RATING ______ |
| | **c. Wire a flower using the piercing method.** | RATING ______ |

d. **Wire a flower using the hook wire method.** RATING______

e. **Make a corsage bow.** RATING______

f. **Make a boutonniere.** RATING______

g. **Make a two-flower corsage.** RATING______

h. **Create a symmetrical arrangement.** RATING______

i. **Create an asymmetrical arrangement.** RATING______

j. **Make a wreath.** RATING______

**OBJECTIVE 1**

1. g
2. p
3. m
4. s
5. e
6. k
7. j
8. i
9. b
10. d
11. r
12. c
13. q
14. n

**OBJECTIVE 2**

c, c, d, a, d

**OBJECTIVE 3**

- Floral foam—A light-weight material that absorbs water and is used to support flowers in arrangements
- Floral tape—A self-sealing tape used to cover stems or wires; often used in corsage or bridal work
- Waterproof tape—Tape used to hold floral foam in a container; only adheres to clean, dry surfaces
- Ribbon—Accessory used to decorate corsages, arrangements, and plants
- Floral preservative—A solution added to water to help extend the life of cut flowers and foliage
- Floral wire—Wire used to strengthen the stems of flower sor foliage, straighten crooked stems, strengthen flower heads, or replace natural stems of flowers or foliage
- Wire pick—Thin stick with wire attached used to support the base or stem of the flower
- Wire netting (or chicken wire)—A wire mesh used as a stem support aid; can be used along, filled with shredded foam, or used to cover a solid floral foam block
- Floral containers—Containers used to hold arrangements; can be made from a variety of materials

**OBJECTIVE 4**

f, c, d, e

**OBJECTIVE 5**

1. c

2. a

3. b

**OBJECTIVE 6**

- Tall vase—Used for long-stemmed flowers
- Urn—Used for medium-sized arrangements
- Deep bowls—Used for large arrangements
- Pedestal—Used for medium-sized arrangements
- Baskets—Used for large arrangements
- Low bowls or oblong trays—Used for many types of arrangements; used primarily for centerpieces
- Goblet—Used for medium-sized arrangements

**OBJECTIVE 7**

1, 2, 3, 4, 7, 8

**OBJECTIVE 8**

- Rhythm—The creation of visual movement or continuity in a design
- Focal point—Area to which a person's attention is immediately drawn
- Balance—A steady and stable appearance
- Proportion—The size relationships of leaves, flowers, foliage, and the container
- Harmony—A look established when all parts of the floral design appear as if they belong together

**OBJECTIVE 9**

1. Inverted T-shape
2. Circular
3. Horizontal
4. Hogarth

5. Triangular
6. Diagonal
7. Vertical
8. Crescent
9. L-shape

**OBJECTIVE 10** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 11** Refer to answers to Assignment Sheet 2.

**OBJECTIVE 12** Refer to Practical Tests for Job Sheets 1 though 10.

**OBJECTIVE SHEET**

# INTRODUCTION TO DECIDUOUS PLANTS

# IX

**INTRODUCTION**

Deciduous plants serve a valuable purpose in a landscape by providing shade or privacy and by adding interest to a home and garden. A landscaper or arborist should know the characteristics of various deciduous trees and shrubs to be able to select the appropriate plants for a landscape. Selecting the most suitable plant for an outdoor area will enhance the appearance of homes, businesses, and gardens for years to come.

**UNIT OBJECTIVE**

After completing this unit, the student should be able to identify deciduous forms and leaf types, list landscape uses, and be able to select the appropriate deciduous plant or shrub for a given landscape situation. The student will demonstrate these competencies by completing assignment sheets and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with deciduous plants to their correct definitions.
2. List features used to identify deciduous plants.
3. Describe parts of a leaf of a deciduous plant.
4. Describe types of leaves associated with deciduous plants.
5. List common deciduous leaf arrangements.
6. Describe types of flowers on deciduous plants.
7. Label deciduous plant forms.
8. List qualities to consider when selecting a deciduous plant for a landscape.
9. List landscape uses for deciduous trees and shrubs.
10. Identify leaf characteristics of deciduous plants. (Assignment Sheet 1)
11. Select true statements regarding deciduous plants. (Assignment Sheet 2)

12. Recommend deciduous plants for various landscape situations. (Assignment Sheet 3)

## SUGGESTED ACTIVITIES

## INTRODUCTION TO DECIDUOUS PLANTS

## IX

### PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Gather books, catalogs, pamphlets, charts, and posters that deal with deciduous plants. (See suggested resources).
- Arrange for guest speakers from a local nursery, garden center, or landscaping company to talk to the class about deciduous plants that are popular in the region and use of deciduous plants in landscaping.

  **NOTE**: Supply guest speakers with the objective sheet, information sheet, and any other components you want them to cover.
- Arrange for a field trip to a park, neighborhood, or arboretum where deciduous plants can be seen. A list of public gardens and arboretums in Oklahoma and vicinity is provided in Unit I, "Introduction to Horticulture."

### DELIVERY

**Objectives 1 through 7**

- Use Information Sheet, Objective 1, to discuss terms and definitions associated with deciduous plants; show students examples of those terms.
- Use Information Sheet, Objectives 2 through 7, to discuss features used to identify deciduous plants, parts of a leaf, types of leaves, leaf arrangements, types of flowers, and plant forms.
- Use Supplement 2 to discuss the meanings of common botanical names. Relate those names to plants in Supplement 3 or plants native to your area.

- Show students photographs of various plant forms and leaf and flower types; have them go through plant books and publications to pick out examples of the various forms.
- Take students on a field trip to an arboretum, park, or nursery to point out examples of the various deciduous plant forms.
- Go through Supplement 3 and discuss the plant form of each deciduous tree or shrub; discuss the leaf and flower types of each evergreen in the supplement.

**Objectives 8 and 9**

- Use Information Sheets, Objectives 8 and 9, to discuss qualities to consider when selecting a deciduous plant for a landscape and landscape uses for various forms of evergreens.
- Visit gardens, parks, and other landscaped areas to determine how and why landscapers selected the plants for those sites. If possible, find the landscaping or architectural firm for that particular site and invite that person to discuss the plant selection process.
- Ask students to evaluate the landscaping of their residences; ask them which deciduous plants they would add or remove from the area, using some of the information supplied in Supplement 3.

**APPLICATION**

**Objectives 10 through 12**

- Discuss Supplement 1, the plant hardiness zone maps for the United States and Oklahoma.
- Discuss the various hardiness zones within Oklahoma and have students go through Supplement 3 to match plants to their hardiness zones.
- Show students examples of the plants described in Supplement 3; if desired, you can test them over identification of these plants by using slides (see suggested resources).
- Have students bring in leaves found in the area and ask them to identify the various leaf characteristics using Supplement 4.
- Have students complete Assignment Sheets 1 through 3.

## EVALUATION

### Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

### Audiovisual Materials

- *4-H Horticulture Identification*, No. VT100, 1 hour, 58 minutes; Oklahoma State University, 1988. This 9-part video is geared toward 4-H volunteer leaders and 4-H agents, but can effectively be used as a general interest plant identification tool. Part 1 covers narrow-leaved evergreens, and Part 2 covers broad-leaved evergreens. 4-H Horticulture Identification Card available to use when watching the tape. Available from Oklahoma State University Agricultural Cooperative Extension centers or Oklahoma State University Agricultural Information Library, 111 PIO, Oklahoma State University, Stillwater, OK 74078.
- *Plant Identification Slide Sets* (Nos. 1, 2, 3, and 4); 50 color slides in each set—200 slides total. Available from: Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407; 800-235-4146 or 805-546-2295.

  **NOTE:** Also available from the above address is *The Backpocket Guide to Ornamental Plants* (handbook)
- *Planting Techniques Part I: Trees and Shrubs*. VHS video. Discusses how successful growth and development of newly installed landscape plants depends on proper plant selection, correct site preparation, use of appropriate planting techniques, and proper follow-up care. Topics include plant selection, site selection, containerized woody plants, planting

a container-grown pear tree, staking trees, bare root trees and shrubs, and balled and burlapped plants. Available from Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407; 1-800-235-4146.

**Computer Software**

- *Deciduous Shrubs I, II, III, and IV, Deciduous Trees I, II, III, and IV, Selecting Trees for The Landscape, Ortho's Computerized Gardening*. Software for IBM or Apple available from: AAVIM, 120 Driftmier Engineering Center, Athens, GA 30602; 404-542-2586

**Publications**

- American Association of Nurserymen (AAN) brochures available from AAN Member Services, 1250 I Street, N.W., Suite 500, Washington, D.C. 20005; 202-789-2900. Brochures include: *How to Use, Select, and Register Cultivar Names*, *Inspection Guide for Landscape Planting*, *Living Screens for North America*, *Special Trees for Special Places*.

**UNIT REFERENCES**

- Mitchell, Paul E. *Plant Science (Landscape Plant and Herbarium Card Reference*. Stillwater, Oklahoma: Cooperative Extension Service, Oklahoma State University, n.d.
- Newton, Deborah and Steve. *Landscape Management: Field Supervisor*. Stillwater, Oklahoma: The Mid-America Vocational Curriculum Consortium, Inc., 1989.
- Reiley, H. Edward and Carroll L. Shry, Jr. *Introductory Horticulture*. Albany, New York: Delmar Publishers Inc., 1988.
- Whitcomb, Carl E., *Know It and Grow It II*. Stillwater Oklahoma: Lacebark Publications, 1983.

**INFORMATION SHEET**

## INTRODUCTION TO DECIDUOUS PLANTS

## IX

**OBJECTIVE 1**

**Match terms associated with deciduous plants to their correct definitions.**

- **Botanical name**—Latin identification of plant materials divided into genus and species
- **Bract**—A modified leaf at the base of a flower or belonging to a cluster of flowers
- **Catkin**—A delicate, scaly-bracted, usually drooping spike of flowers

  EXAMPLE: Male flowers on oaks
- **Conifer**—Plant that bears cones

  NOTE: Not all conifers are evergreens. For example, the Bald Cypress is deciduous.
- **Common name**—Plant name used by the general public
- **Cultivar**—A cultivated variety of plant that will retain its distinguishing features when reproduced
- **Deciduous**—Plants that lose their foliage at the end of the growing season
- **Dormant**—Not actively growing, but capable of resuming growth when environmental conditions become favorable
- **Evergreens**—Plants that keep their foliage year round
- **Hardiness**— The ability of a plant to survive in cold temperatures

  NOTE: The U.S. Department of Agriculture has divided the country into hardiness zones of 10-degree increments. Plants are rated according to hardiness. See Supplement 1.
- **Holdfasts**—Small, circular discs at the tips of some tendrils

  EXAMPLE: Virginia Creeper
- **Resistant**—Tolerant and capable of withstanding adverse conditions or pests

- **Specimen plant**—Any plant displayed to its best advantage either alone or in multiple plantings
- **Tendrils**—Usually slender organs on a vine used for climbing; formed by modification of a branch, leaf or flower stalk

  EXAMPLE: Grape vine
- **Twining**—Climbing by using the main stem or branches to wind around an object

  EXAMPLE: Chinese Wisteria

## OBJECTIVE 2

**List features used to identify deciduous plants.**

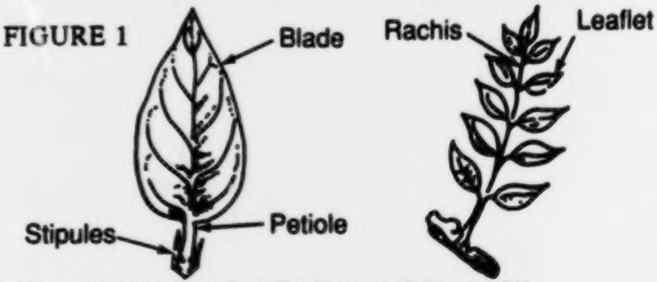
- Flower type
- Fruit type
- Leaf shape and arrangement
- Stem type
- Bark
- Plant shape (form)

## OBJECTIVE 3

**Describe parts of a leaf of a deciduous plant.**

- Stipules—Secondary growth at the base of a petiole
- Petiole—Stalk at the base of a leaf (leaf stem)
- Blade—Expanded, flattened portion of a leaf, attached to the petiole
- Rachis—Central stem of compound leaves
- Leaflet—a single division of a compound leaf

FIGURE 1



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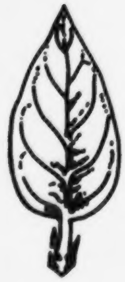
**OBJECTIVE 4** **Describe types of leaves associated with deciduous plants.**

- Simple—Leaf that is one solid piece; undivided

  EXAMPLE: River birch, Redbud

  FIGURE 2



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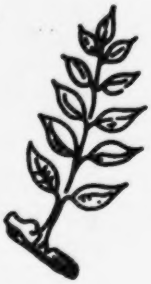
- Pinnately compound—Leaf with leaflets arranged opposite each other along the rachis

  EXAMPLE: Green Ash

  FIGURE 3



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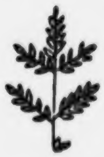
- Bi-pinnately compound (twice pinnate)—Leaf with leaflets that are also compound or divided

  EXAMPLE: Kentucky Coffee Tree, Chinaberry

  FIGURE 4



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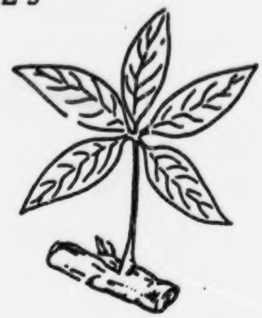
- Palmately compound—Leaf divided into sections so that it appears like fingers on a hand

  EXAMPLE: Texas Buckeye, Virginia Creeper

  FIGURE 5



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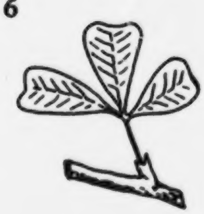
- Trifoliate—Having three leaves, leaflets, or leaf-like parts

  EXAMPLES: Poison Ivy, Winter Jasmine

  FIGURE 6



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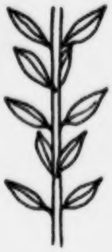
**OBJECTIVE 5**

**List common deciduous leaf arrangements**

- Opposite—Directly across from each other

  EXAMPLES: Dogwood, maples

  FIGURE 7



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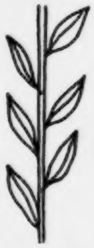
- Alternate—Found at different levels along a stem

  EXAMPLE: River Birch, Redbud

  FIGURE 8



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**OBJECTIVE 6** **Describe types of flowers on deciduous plants.**

- Conspicuous—Prominent, showy

  EXAMPLES: Redbud (tree); Forsythia (shrub)

- Inconspicuous—Insignificant; not readily seen

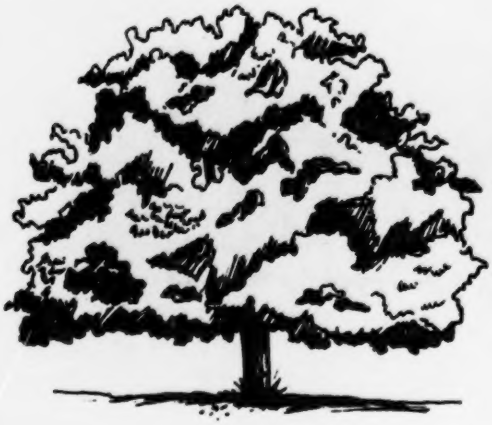
  EXAMPLES: Lacebark Elm (tree); Winged Euonymus (shrub)

**OBJECTIVE 7** **Label deciduous plant forms.**

- Oval to rounded

  EXAMPLE: Sugar Maple

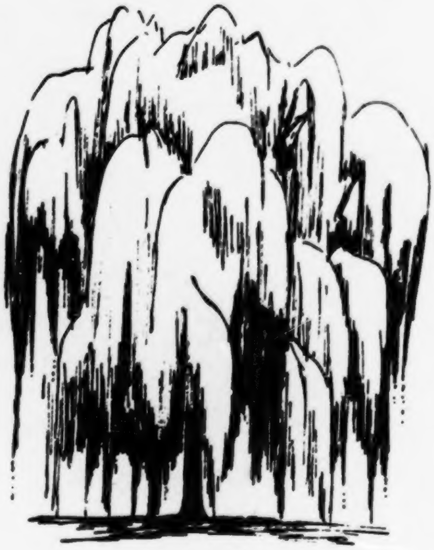
  FIGURE 9



Weeping

EXAMPLE: Weeping Willow

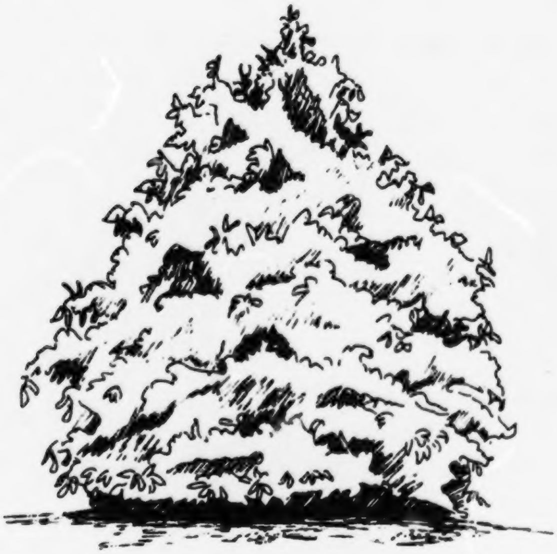
FIGURE 10



- Pyramid or conical with a central leader

  EXAMPLE: Sweetgum

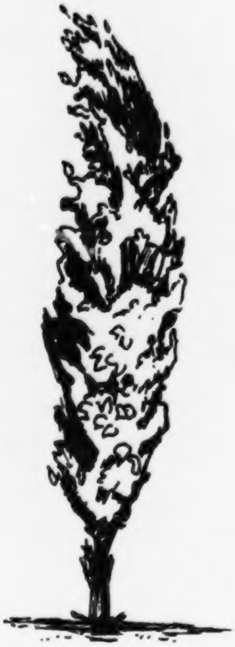
  FIGURE 11



Columnar

EXAMPLE: Lombardi Poplar

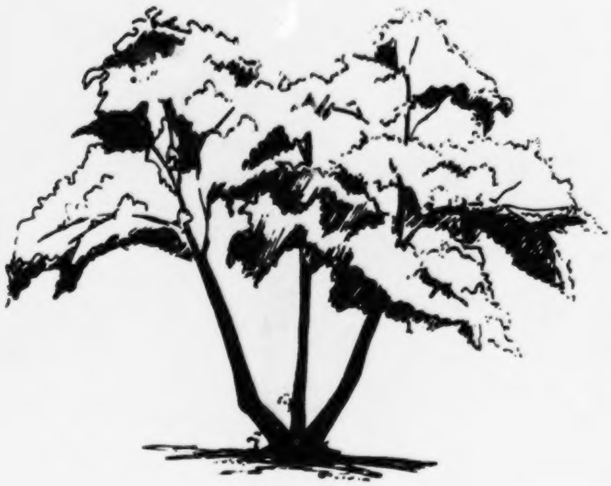
FIGURE 12



- **Multiple trunk**

  **EXAMPLE: River Birch**

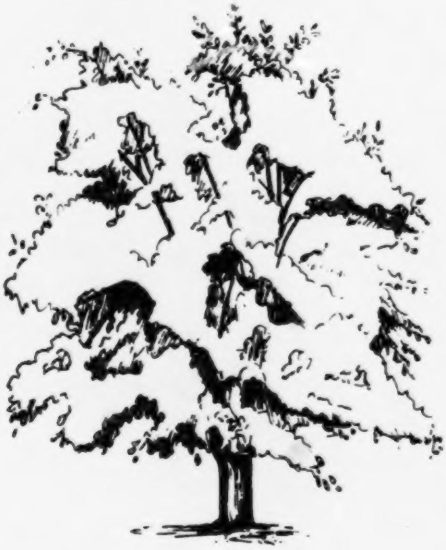
  **FIGURE 13**



**Irregular form**

**EXAMPLE: Russian Olive**

**FIGURE 14**



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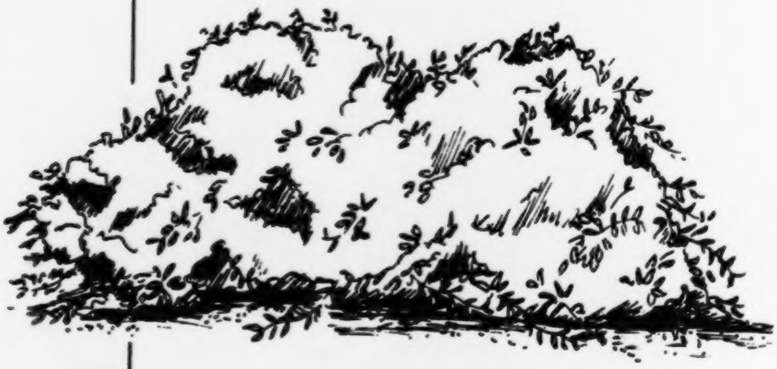
- Low, spreading

  EXAMPLE: Winter Jasmine

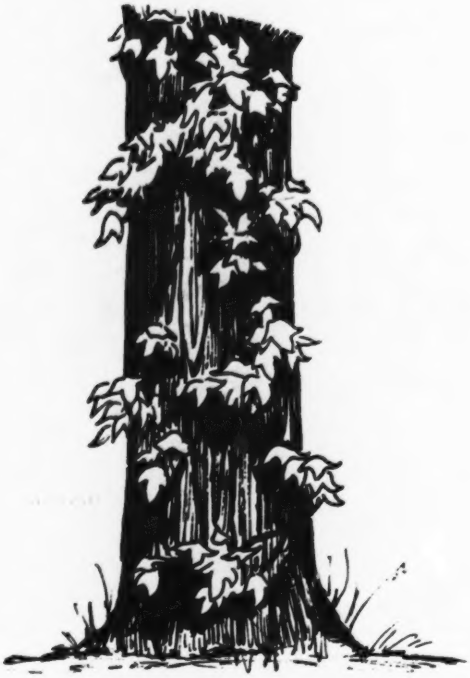
  FIGURE 15



- Vine

  EXAMPLE: Chinese Wisteria

  FIGURE 16



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**OBJECTIVE 8**

**List qualities to consider when selecting a deciduous plant for a landscape.**

- Hardiness zone (Climate)
- Exposure
- Size
- Form (or shape)
- Color
- Texture
- Soil requirements
- Insect or pest problems

**OBJECTIVE 9**

**List landscape uses for deciduous trees and shrubs.**

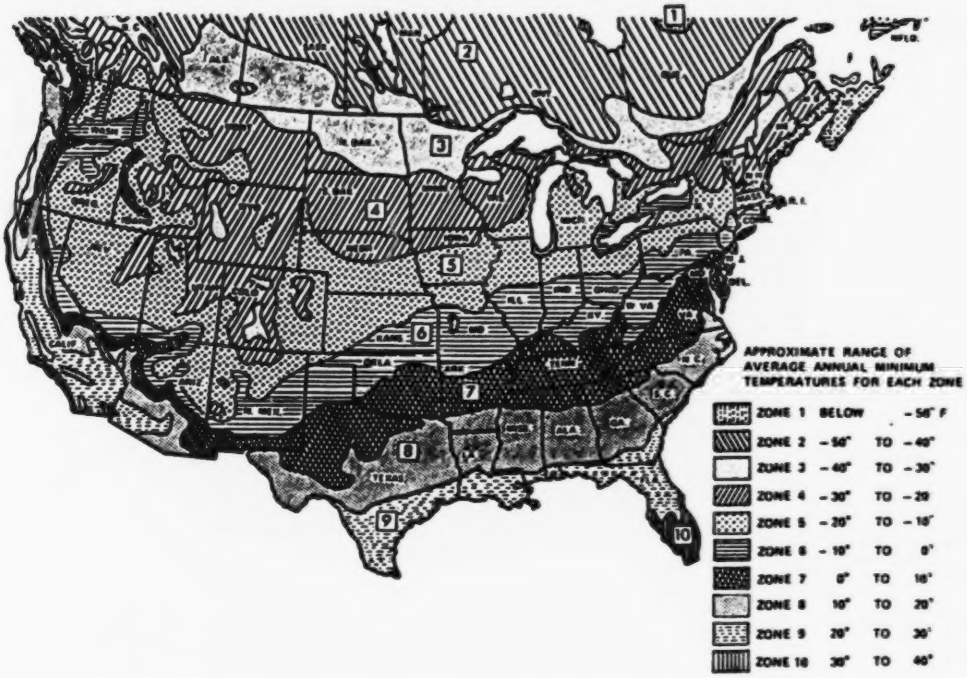
**Trees**

- Provide shade—A tree planted in the right location can keep temperatures in a home cooler and, at the same time, provide shade outdoors
- Frame a house or a view
- Add interest or fill in bareness—Properly placed trees can help soften the sharp lines of a home
- Act as a screen or provide privacy

**Shrubs**

- Form borders around buildings or along walkways
- Provide a background for a landscape
- Act as a screen or provide privacy
- Provide accent or add interest to a garden or building

## Plant Hardiness Zone Map of the United States


1
2
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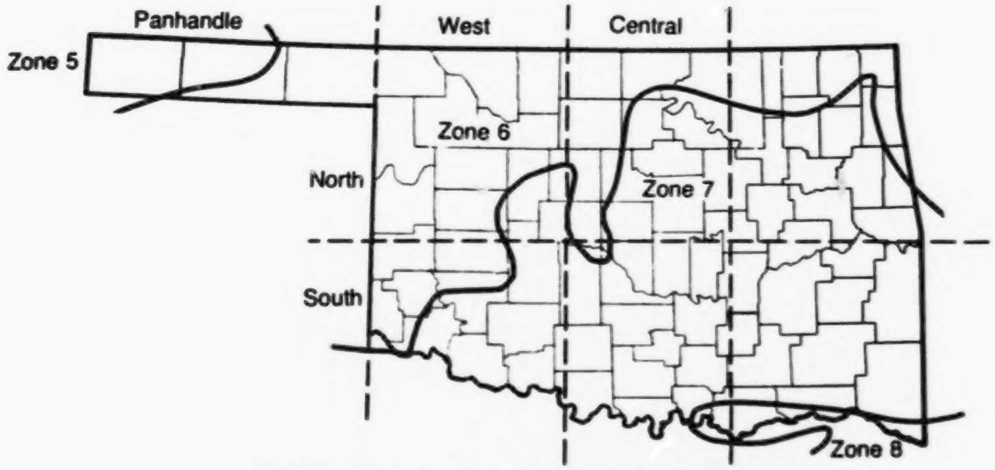
10
APPROXIMATE RANGE OF AVERAGE ANNUAL MINIMUM TEMPERATURES FOR EACH ZONE
ZONE 1 BELOW -50° F
ZONE 2 -50° TO -40°
ZONE 3 -40° TO -30°
ZONE 4 -30° TO -20
ZONE 5 -20° TO -10°
ZONE 6 -10° TO 0°
ZONE 7 0° TO 10°
ZONE 8 10° TO 20°
ZONE 9 20° TO 30°
ZONE 10 30° TO 40°

## Plant Hardiness Zone Map for Oklahoma


Panhandle
West
Central
Zone 5
Zone 6
North
Zone 7
South
Zone 8

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**Parts of a plant's botanical name**

- Genus—The first name in a botanical name; always capitalized and italicized (or underlined)
- Species—The second name in a botanical name; not capitalized but is also italicized (or underlined)
- Cultivar (Cultivated + variety)—Named variety of a plant; listed after the species name; capitalized and is surround by single quotation marks

EXAMPLE: Common name: Callery Pear
Botanical name: *Pyrus calleryana*
Genus: *Pyrus*
Species: *calleryana*
Cultivar: 'Bradford'

**Meanings of common botanical names**

Albidus, albus—White

Aureus—Golden

Baccatus—With berries

Bi—Two

Brachy—Short

Examples: Brachycarpus With short fruit

Brachyphyllus—With short leaves

Chinensis—From China

Compactus—Compact, dense

Macro—Large

Example: Macrocarpus—With large fruit

Major—Large, larger

Micro—Small

Example: Microphyllus—With small leaves

Minor—Small

Mono—One

Nigra—Dark, black

Cyaneus—Blue

Diffusus—Spreading

Domesticus—Domesticated or cultivated

Elatus—Tall

Elegans—Elegant, handsome

Fallax—False or deceptive

Flavus—Yellow

Flore-pleno—With full or double flowers

Floribundus—Free-flowering, blooming abundantly

Fragrans—Fragrant

Gracilis—Graceful, slender

Gradifolius—With large leaves

Gradiflorus—With large flowers

Japonica—From Japan

Luteus—Yellow

Paniculatus—With flowers in compound racemes or panicles

Poly—Many

Procumbens—Flat or trailing

Pungens—Piercing, sharp-pointed

Repens—Creeping

Robustus—Strong, robust

Roseus—Rosy, pink

Rubens, rubra—Red, ruddy

Sempervirens—Evergreen

Speciosus—Showy, good-looking

Stellatus—Star-like

Tri—Three

Variegatus—Variegated, usually of different colors

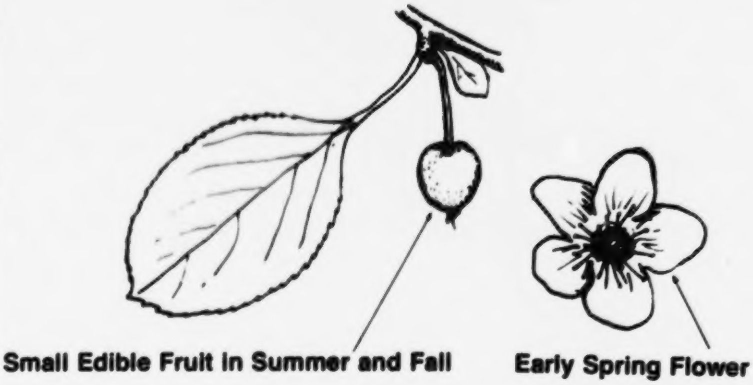
Virens, viridis—green

Vulgaris—vulgar, common, usual

## SOME DECIDUOUS TREES AND THEIR CHARACTERISTICS

FIGURE 1

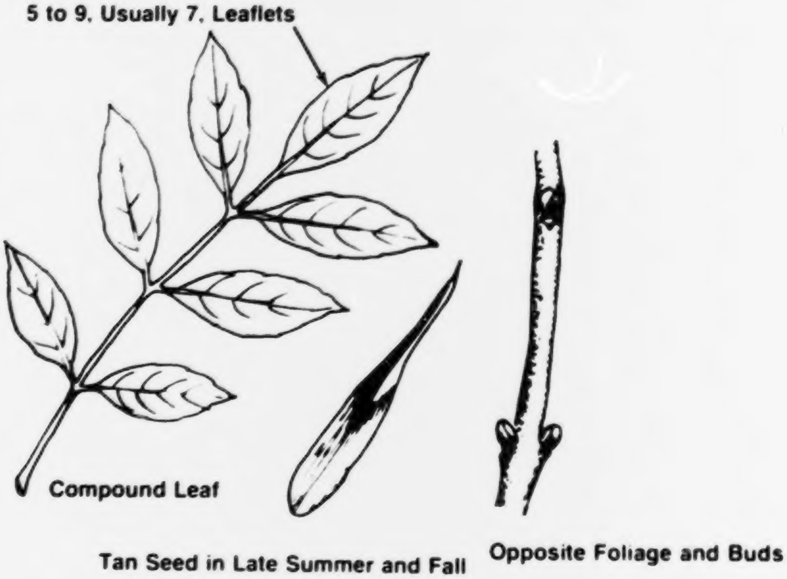
### Apple, Flowering Crab


Small Edible Fruit in Summer and Fall
Early Spring Flower

Common name: Apple, Flowering Crab
Botanical name: *Malus species*
Hardiness zone: 3
Exposure: Sun
Size: Height 20-30 feet; spread 15-25 feet
Form: Irregular round top to spreading
Flower: Conspicuous apple blossom type flower
Color: Green foliage, some varieties early growth with reddish tinge; white to pinkish-rose flower in spring; reddish fruit in mid-summer to fall
Texture: Medium
Soil: Medium fertility; stunts in clay
Pest problems: Leaf defoliators, scale, fire blight, rust; more susceptible to fire blight when forced by too much fertilizing or heavy pruning
Landscaping comments: Good shade foliage and showy, non-poisonous fruit; medium growth rate

FIGURE 2

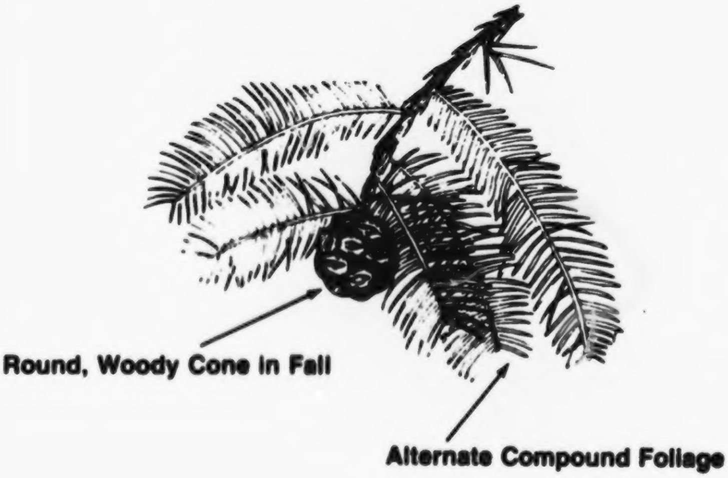
## Ash, Green


5 to 9, Usually 7, Leaflets
Compound Leaf
Tan Seed in Late Summer and Fall
Opposite Foliage and Buds

Common name: Ash, Green
Botanical name: *Fraxius pennsylvanica lanceolata*
Hardiness zone: 2
Exposure: Sun or part shade
Size: Height 40-70 feet; spread 30-50 feet
Form: Round top
Flower: Inconspicuous male and female flowers on separate trees in spring
Color: Dark green foliage; light greenish-tan fruit late summer to fall Bright golden-yellow fall color
Texture: Medium
Soil: Good drainage; medium fertility
Pest problems: Common shade tree pests; borers, if grown in clay
Landscaping comments: Unprotected trunk and branches of young trees susceptible to sunscald; leaves emerge late in spring; deep soil preferred; good shade tree; rapid grower

FIGURE 3

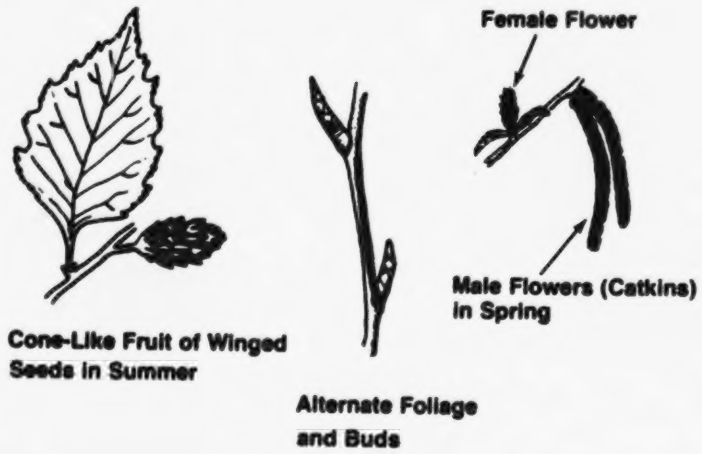
## Baldcypress



Common name: Baldcypress
Botanical name: *Taxodium distichum*
Hardiness zone: 4
Exposure: Sun or part shade
Size: Height 50-150 feet; spread 50-75 feet
Form: Upright, conical
Flower: Inconspicuous spring flowers
Color: Light green fern-like foliage turning rusty red in autumn; green cones in late summer and fall
Texture: Fine foliage; medium to fairly coarse branches
Soil: Good for poor drainage; medium fertility
Pest problems: None serious
Landscaping comments: Natural habitat is near water; older trees produce vertical root extensions commonly called "cypress knees." Spring and summer growth resembles narrow-leaved evergreens; slow growth rate; drought tolerant.

FIGURE 4

## Birch, River

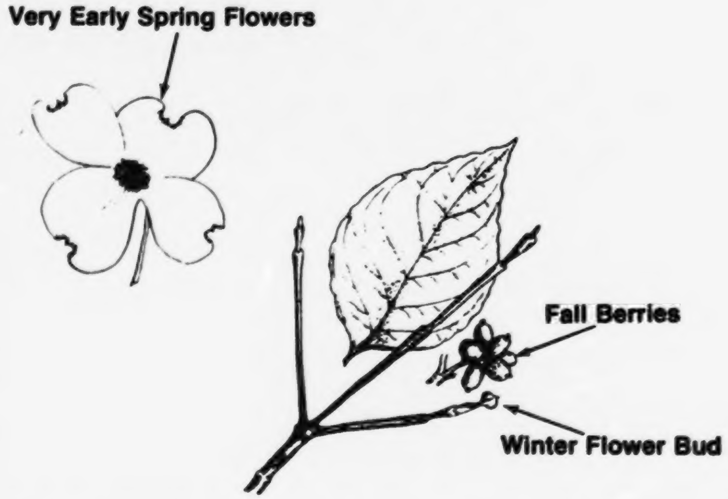

Female Flower
Male Flowers (Catkins) in Spring
Cone-Like Fruit of Winged Seeds in Summer
Alternate Foliage and Buds

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Birch, River
Botanical name: *Betula nigra*
Hardiness zone: 2
Exposure: Part shade
Size: Height 40-70 feet; spread 20-40 feet
Form: Upright, open
Color: Medium green shiny foliage
Texture: Medium; trunk coverd with papery layers of bark
Soil: Tolerates most soil so long as adequate moisture is available
Pest problems: None serious
Landscaping comments: Susceptible to drought damage when not planted close to water; adaptable to multiple trunk use

FIGURE 5

## Dogwood, Flowering

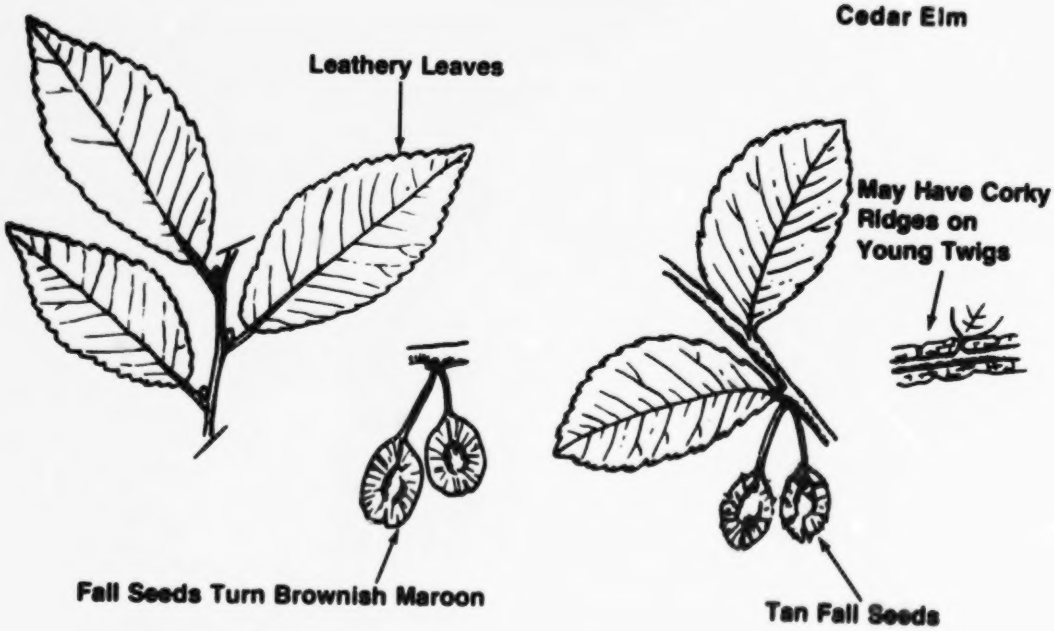


Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Dogwood, Flowering
Botanical name: *Cornus florida*
Hardiness zone: 4
Exposure: Part shade
Size: Height 12-25 feet; spread 15-20 feet
Form: Semi-round top, horizontal branching; dense to fairly open, single "flowers" average 2 inches in diameter, small berry clusters, opposite branching twigs and leaves
Flower: White flower—occasionally pink—in early spring
Color: Medium green foliage; red fall foliage; red fruit in fall
Texture: Medium
Soil: Good drainage essential; medium fertility
Pest problems: Dogwood borers, especially through bark wounds
Landscaping comments: Suffers sunscald damage to trunk and branches unless in shade; poor choice for a street tree; difficult to transplant; best planted from a container; medium growth rate

FIGURE 6

## Elm, Lacebark

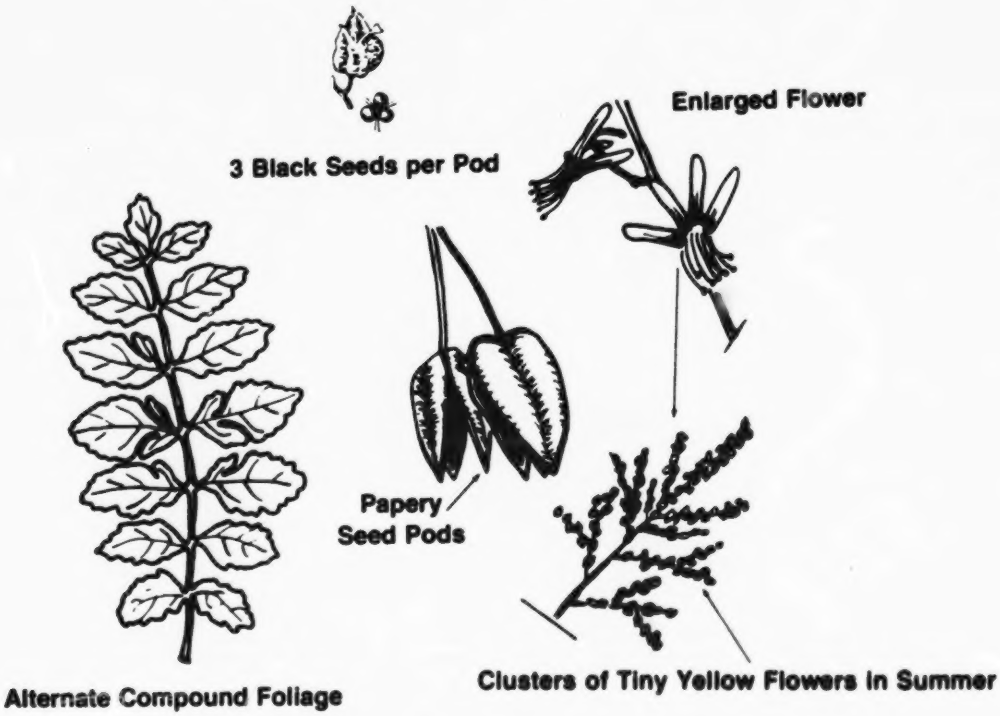

Cedar Elm
Leathery Leaves
May Have Corky Ridges on Young Twigs
Fall Seeds Turn Brownish Maroon
Tan Fall Seeds

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Elm, Lacebark
Botanical name: *Ulmus parvifolia*
Hardiness zone: 4
Exposure: Sun
Size: Height 30-60 feet; spread 30-60 feet
Form: Semi-vase shape to irregular and spreading; dense to fairly open
Flower: Inconspicuous flower in late spring and fruit in fall
Color: Leathery dark green foliage; yellow to maroon fall color; maroon to brown showy disc-like clusters of fruit in September and October
Texture: Medium; peeling bark
Soil: Medium to slow drainage; medium fertility
Pest problems: Resistant to Dutch Elm Disease and Elm Leaf Beetle; pests seldom serious
Landscaping comments: Moderate to fast growth rate; extremely drought and wind resistant; will grow virtually anywhere; tolerates parking lots, poor soil

FIGURE 7

## Goldenrain Tree

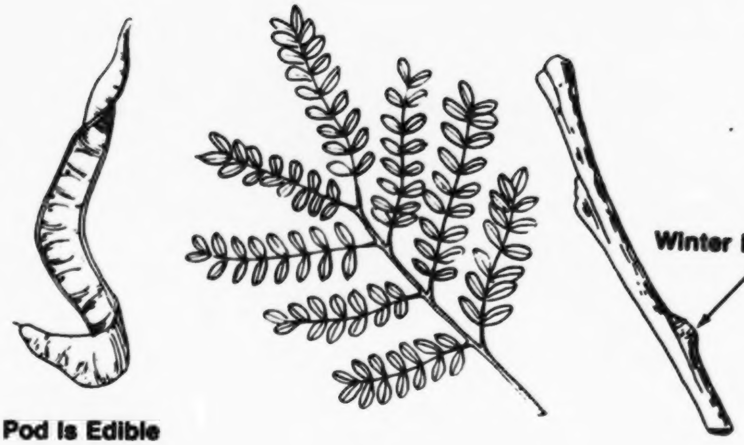

3 Black Seeds per Pod
Enlarged Flower
Papery Seed Pods
Alternate Compound Foliage
Clusters of Tiny Yellow Flowers in Summer

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Goldenrain Tree
Botanical name: *Koelreuteria paniculata*
Hardiness zone: 5
Exposure: Sun or part shade
Size: Height 20-30 feet; spread 15-20 feet
Form: Upright, irregular to rounded
Color: Medium green foliage; yellow flowers for about 2 weeks on different trees from June to August; showy pods chartreuse to tan mid-summer to fall
Texture: Medium; fairly coarse twigs
Soil: Good drainage essential; medium fertility
Pest problems: Boxelder bugs may be a nuisance in autumn
Landscaping comments: Occasionally susceptible to late freeze damage; Relatively short-lived, 25-40 years; medium growth rate; very adaptable, tolerant and attractive

FIGURE 8

## Honeylocust, Thornless

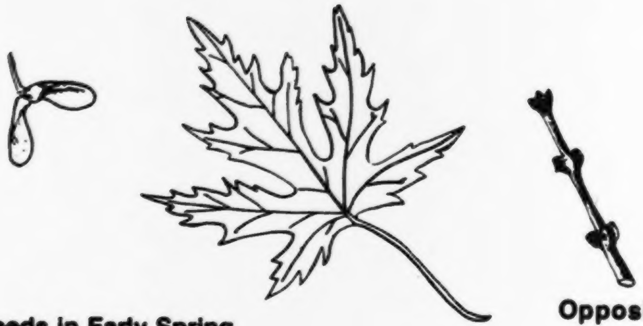

Flat, Twisted Bean 10-18 In. Long on Female Trees
Pod Is Edible
Winter Bud
2-Compound Alternate Foliage

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Honeylocust, Thornless
Botanical name: *Gleditsia triacanthos inermis*
Hardiness zone: 4
Exposure: Sun
Size: Height 50-75 feet; spread 25-40 feet
Form: Upright, irregular
Flower: Inconspicuous spring flower, male catkin on one tree, female flower on another
Color: Medium green foliage sometimes yellow in fall; green fruit turns dark brown in fall
Texture: Fine to medium foliage; medium to coarse twigs; allows good winter sun penetration
Soil: Native to rich, moist bottomlands, but tolerates almost any soil
Pest problems: Mimosa Web Worm, Locust borer, pod-gall
Landscaping comments: Young tree trunks highly susceptible to sunscald; to avoid thorns and seed pods plant only named cultivars; due to pests it is an unwise selection for Central and Eastern Oklahoma; very drought tolerant

FIGURE 9

## Maple, Silver

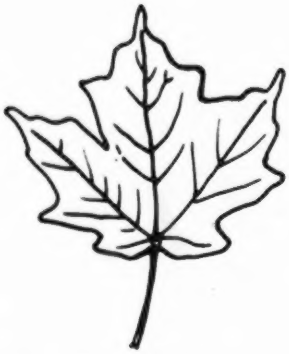

Pairs of Winged Seeds in Early Spring
Opposite Leaves

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

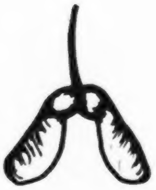
Common name: Maple, Silver
Botanical name: *Acer saccharinum*
Hardiness zone: 4
Adaptation: All
Exposure: Sun
Size: Height 60-80 feet; spread 50-75 feet
Form: Upright
Flower: Inconspicuous flower and paired winged fruits in spring
Color: Medium green foliage with silvery green underside, yellowish fall color, tinged with red sometimes
Texture: Medium
Soil: Grows in almost any soil, except poorly drained clay
Pest problems: None serious
Landscaping comments: Brittle wood breaks easily and could become a hazard in wind or ice storms; roots compete with other plantings, including lawns; should only be used where other trees will not grow; rapid grower

FIGURE 10

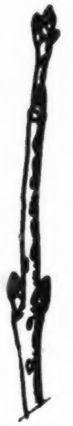
## Maple, Sugar



**Lower Lobes Not Always Well Developed**



**Pairs of Winged Seeds in Summer**

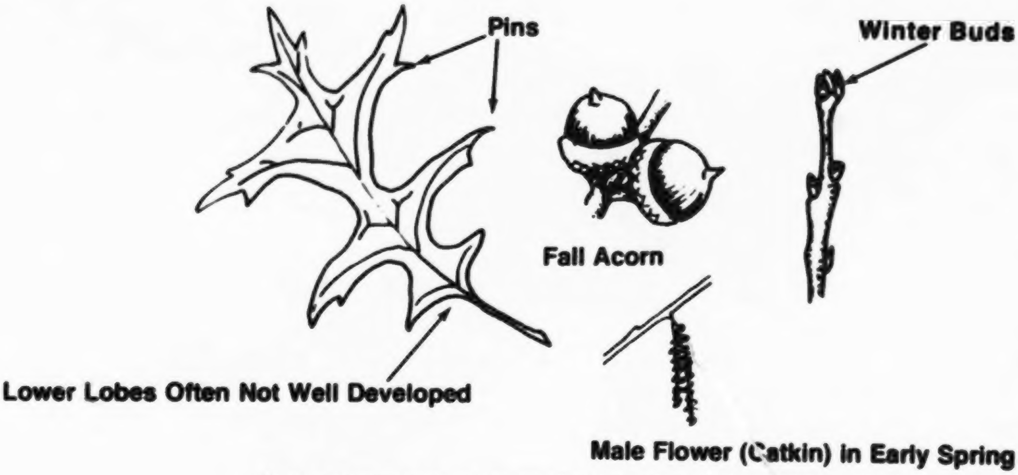


Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Maple, Sugar
Botanical name: *Acer saccharum*
Hardiness zone: 3
Exposure: Sun or part shade
Size: Height 50-75 feet; spread 40-60 feet
Form: Conical to round top
Flower: Inconspicuous flower in early spring, paired winged (samara) seeds mature form March to June
Color: Dark green foliage in summer; yellow to scarlet in autumn. Fall color varies genetically with each tree
Texture: Medium to slightly coarse
Soil: Good drainage; medium to high fertility
Pest problems: Young trees susceptible to sunscald and borers if not protected; drought damage
Landscaping comments: Grows better in association with other trees

FIGURE 11

## Oak, Pin

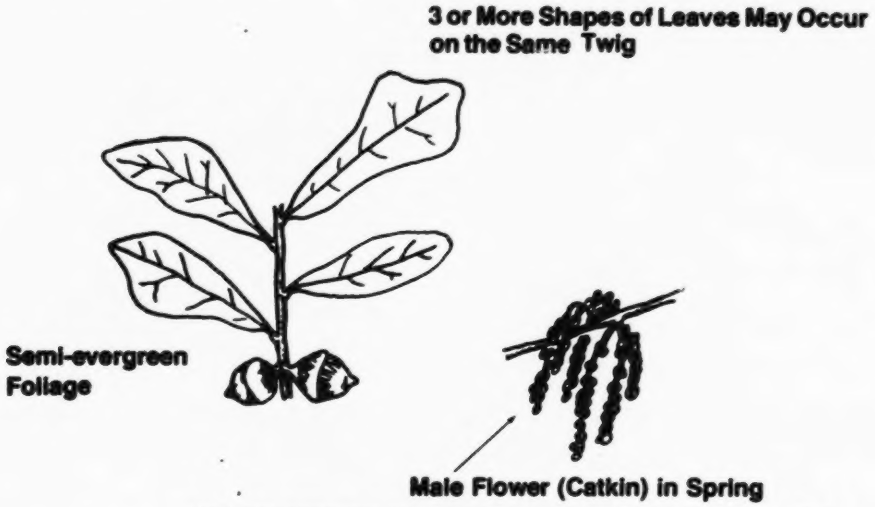

Pins
Winter Buds
Fall Acorn
Lower Lobes Often Not Well Developed
Male Flower (Catkin) in Early Spring

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Oak, Pin
Botanical name: *Quercus palustris*
Hardiness zone: 3
Exposure: Sun or part shade
Size: Height 75-90 feet; spread 30-50 feet
Form: Upright, conical
Flower: Male catkins and inconspicuous female flowers in spring; fruit is acorn in fall
Color: Medium to dark green foliage, red fall color, but some trees turn only brown. Foliage turns brown with cold weather and hangs on the tree until late winter.
Texture: Medium to slightly coarse
Soil: Medium to good drainage; very sensitive to poorly drained or compacted soils or alkaline soils
Pest problems: Kermes and San Jose Scale and Gouty and horned oak gall insects
Landscaping comments: Much overplanted, subject to chlorosis (iron and magnesium deficiency), in alkaline soils, corrected by addition of sulfur, iron compounds and Epsom salts

FIGURE 12

# Oak, Water

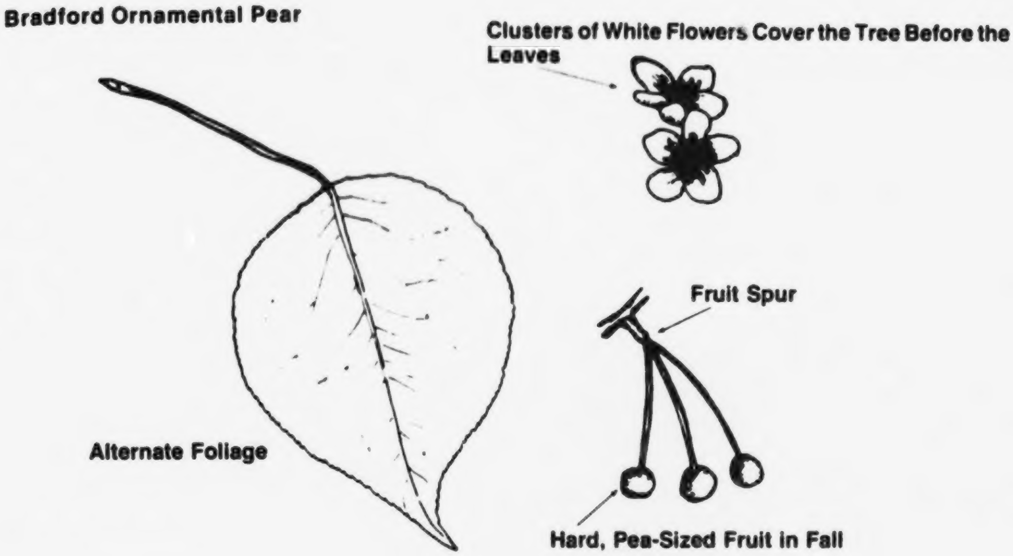

3 or More Shapes of Leaves May Occur on the Same Twig
Semi-evergreen Foliage
Male Flower (Catkin) in Spring

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Oak, Water
Botanical name: *Quercus nigra*
Hardiness zone: 6
Exposure: Sun or part shade
Size: Height 60-80 feet; spread 30-50 feet
Form: Semi-conical to round, irregular top
Flower: Male catkins and inconspicuous female flowers in spring; fruit is acorn
Color: Dark green, glossy foliage; semi-evergreen (fall and part of winter). While other trees are colored this tree remains bright green
Texture: Medium
Soil: Tolerates most soils; native to swamp, wet low-lands
Pest problems: Scale insects
Landscaping comments: A quality plant for seasonal color effect and general specimen use; medium growth rate

FIGURE 13

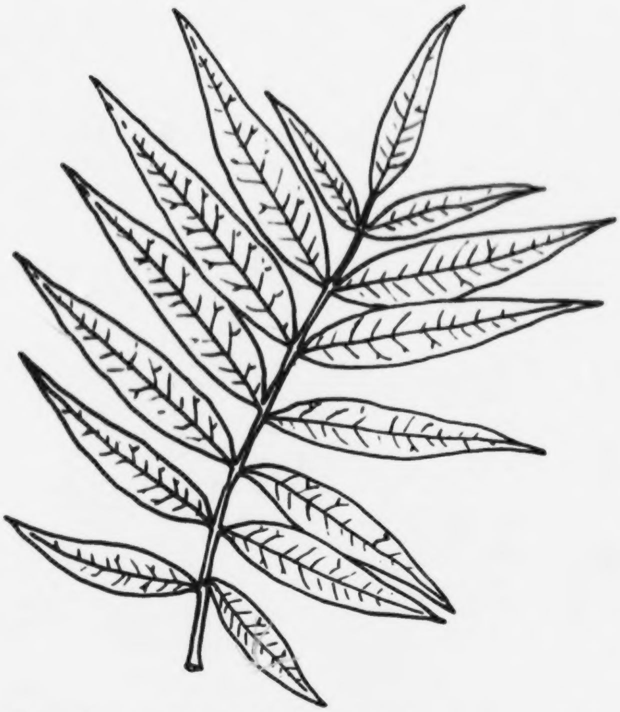
## Pear, Callery


Bradford Ornamental Pear
Clusters of White Flowers Cover the Tree Before the Leaves
Fruit Spur
Alternate Foliage
Hard, Pea-Sized Fruit in Fall

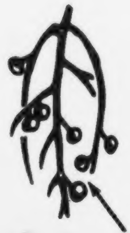
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Pear, Callery
Botanical name: *Pyrus calleryana*
Hardiness zone: 4
Exposure: Sun
Size: 30-40 feet tall and 15-35 feet spread
Form: Oval to round crown
Color: Dark glossy green foliage turns orange to red-orange in late fall; small white flowers in early spring
Texture: Medium; some spines
Soil: Almost any soil; tolerant of urban conditions and poor soils
Pest problems: None serious
Landscaping comments: Excellent, moderate sized tree for city conditions and heavy clay soils; durable, strong, wind and vandal resistant wood; drought resistant; desirable for shade and ornamental use. Cultivar: 'Bradford'— A thornless, upright oval form with rich red fall color, a USDA introduction. Showy white flowers in early spring generally fruitless. May be no fall foliage color in Zone 8 and further south.

FIGURE 14



**Leaves Have Strong Odor When Crushed**



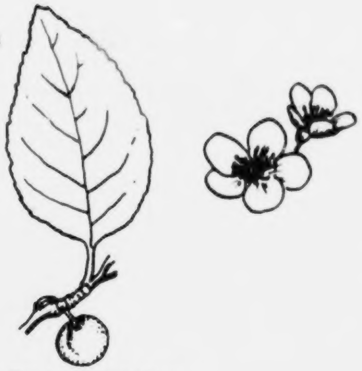
**Dark Red Fruit on Female Trees in Fall**

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Pistache, Chinese
Botanical name: *Pistacia chinensis*
Hardiness zone: 6
Exposure: Sun
Size: Height 20-40 feet; spread 20-30 feet
Form: Rounded to vase-shaped crown
Color: Foliage is medium to dark green turning yellow to red-orange in fall. Small fruit turns purple-red in fall
Texture: Medium to fine
Soil: Almost any
Pest problems: None
Landscaping comments: Extremely drought and heat tolerant

FIGURE 15

## Purple Leafed Plum



Alternate Foliage Remains Purple During Summer

Spring Flowers

Purple Summer Fruit Is Edible. Do Not Eat Green Fruit, Leaves or Twigs.

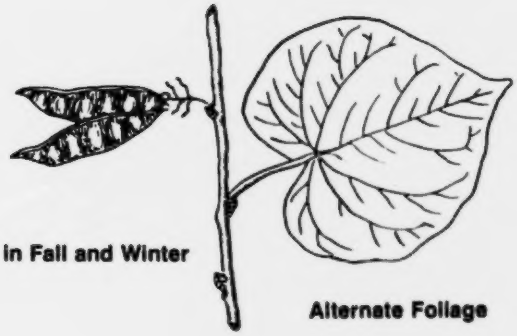
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

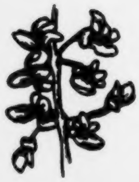
Common name: Purple-leaved Plum
Botanical name: *Prunus cerasifera*
Hardiness zone: 3
Exposure: Full sun to partial shade
Size: 15-25 feet tall and 10-12 feet spread
Form: Upright oval
Color: Foliage is rich purple all season; light pink flowers in spring
Texture: Dense, medium
Soil: Any well-drained soil, not clay
Pest problems: Borers, especially on poorly drained clay soils.
Landscaping comments: In general lives about 10 to 12 years; tolerates heat and drought moderately well; very dominating in landscape

FIGURE 16

## Redbud, Eastern

**State Tree of Oklahoma**


Bean Pod in Fall and Winter
Alternate Foliage



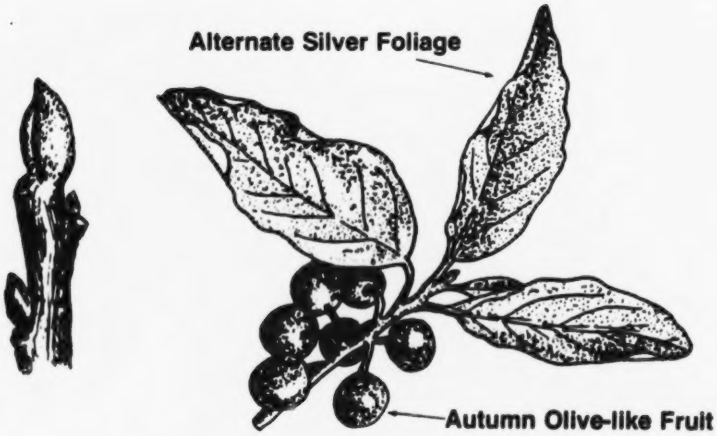
**Cerise-Rose Pea Flowers Appear Before Leaves**

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Redbud, Eastern
Botanical name: *Cercis canadensis*
Hardiness zone: 4
Exposure: Part shade
Size: Height 15-40 feet; spread 12-30 feet
Form: Round top to irregular
Color: Dark green foliage, soft yellow in fall; cerise-pink flower in early spring; green to brown bean in late summer and fall—sometimes unsightly with maturity
Texture: Medium to slightly coarse
Soil: Grows in poor soils and hot, dry locations, but is not well adapted to poorly drained clay
Pest problems: Leaf rollers, aphids, spider mites, leaf diseases
Landscaping comments: Young trees susceptible to sunscald, fairly difficult to transplant; slow to medium growth rate; attractive when in bloom

FIGURE 17

## Russian Olive

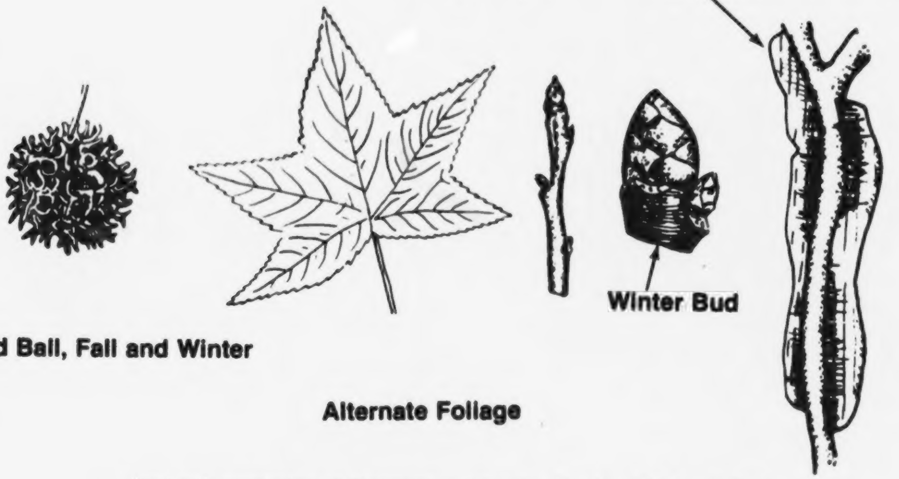


Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Russian Olive
Botanical name: *Elaeagnus angustifolia*
Hardiness zone: 2
Exposure: Sun
Size: Height 12-25 feet; spread 15-20 feet
Form: Shrubby irregular tree
Flower: Inconspicuous fragrant flowers in May; dark-gray drooping fruit matures in August and September
Color: Silver-gray foliage
Soil: Tolerates a wide range of soils with good drainage
Pest problems: None serious
Landscaping comments: Not a long-lived tree in Oklahoma, 15-25 years usually. Planted in shelterbelts and for wildlife, drought tolerant; medium to fast growth rate; provides foliage contrast and fragrance in landscape

FIGURE 18

## Sweetgum, American

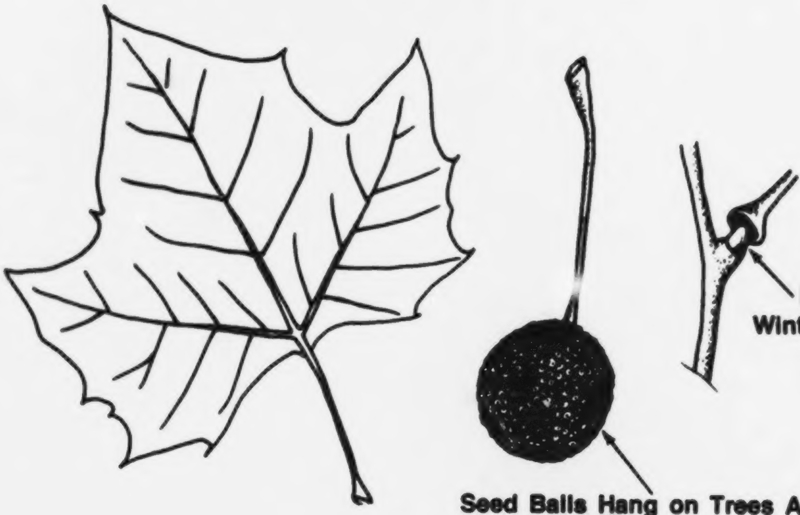

Corky Ridges on Young Twigs Is Common
Winter Bud
Woody Seed Ball, Fall and Winter
Alternate Foliage

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Sweetgum, American
Botanical name: *Liquidambar styraciflua*
Hardiness zone: 4
Exposure: Sun or part shade
Size: Height 60-120 feet; spread 50-75 feet
Form: Upright pyramid to rounded with age
Flower: Inconspicuous flowers in spring
Color: Dark green foliage, brilliant red to yellow to mixed in fall
Texture: Medium, twigs may have corky ridges or wings
Soil: Poor to good drainage; tolerates clay; medium to high fertility
Pest problems: Leaf webworms
Landscaping comments: Very little drought resistance. Native to the swamp. Much overplanted; poor choice for a street tree in most cities; brown woody balls burn nicely in a fireplace; slow growth rate

FIGURE 19

## Sycamore or American Plane Tree



Leaf Fits Over Winter Bud Like a Cap

Seed Balls Hang on Trees All Winter. Somewhat Messy When They Fall

Large Alternate Foliage

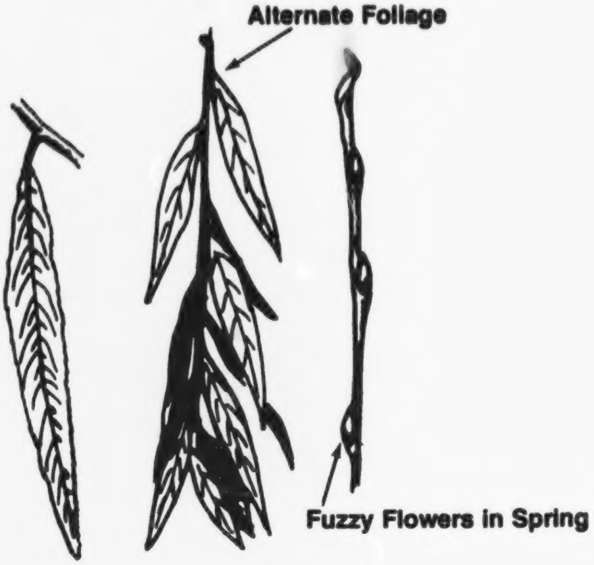
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Sycamore or American Plane Tree
Botanical name: *Platanus occidentalis*
Hardiness zone: 3
Exposure: Sun
Size: Height 75-150 feet; spread 60-100 feet
Form: Young trees upright pyramid with central leader; older trees irregular, upright
Flower: Inconspicuous flower in early spring
Color: Light green foliage sometimes yellowish fall color; bark of mature trees light gray to white; greenish-tan fruit balls hang on tree and drop throughout the winter
Texture: Medium to coarse
Soil: Clay loam to sandy loam; medium drainage; does not tolerate poorly drained clay

Pest problems: Anthracnose disease is serious in wet cool springs; leaf defoliators, lacebug. London Plane Tree, *Platanus acerifola*, has two seed balls per stem and is more resistant to anthracnose disease
Landscaping comments: Often overplanted. Should not be planted on streets where pest prevention would be a problem or where litter would pose a disposal problem; tolerates drying wind and sun if roots have moisture; only use where there is ample room to grow such as park, large estate, open area

FIGURE 20

**Weeping Willow**



Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

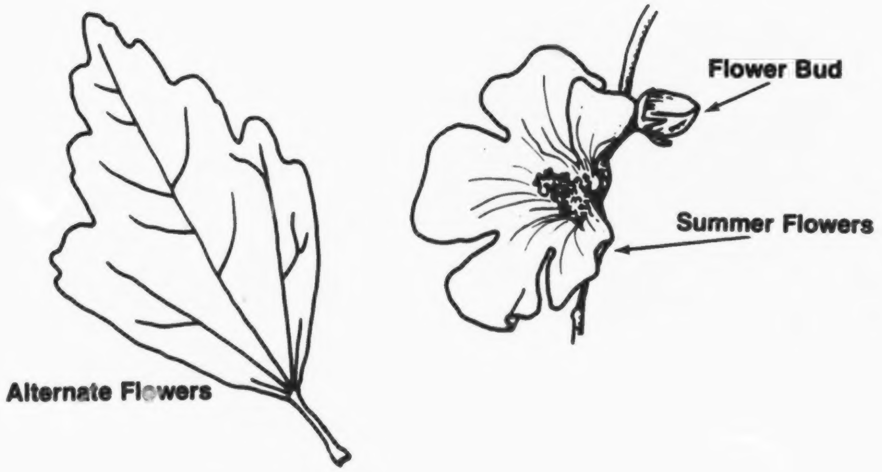
Common name: Weeping Willow
Botanical name: *Salix babylonca*
Hardiness zone: 3
Exposure: Sun or part shade
Size: Height 40-60 feet; spread 30-50 feet
Form: Weeping, branching to several scaffold branches; fairly compact; male catkins and inconspicuous female flower in spring
Flower: Pale yellow catkins in early spring followed by a small capsule; fruit seldom seen
Color: Medium green foliage; yellowish fall color

Texture: Tolerates wide range of soils so long as adequate moisture is present Soils: Grows poorly and has short life in heavy clay soils
Pest problems: Leaf defoliators, stem cankers, bacterial crown gall
Landscaping comments: Suffers from extended drought conditions, use near water. Do not plant near the sewer. Short lived, 10-25 years

## SOME DECIDUOUS SHRUBS AND THEIR CHARACTERISTICS

FIGURE 21

### Althea, or Rose-of-Sharon



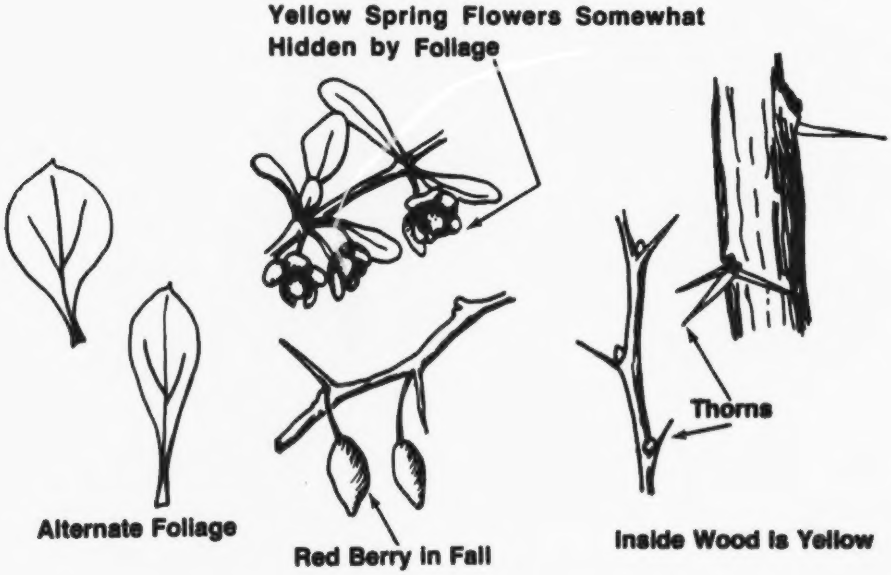
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Althea, or Rose-of-Sharon
Botanical name: *Hibiscus syriacus*
Hardiness zone: 5
Exposure: Sun or part shade
Size: Height 5-8 feet, spread 4 feet
Form: Upright, partly spreading
Flower: Single or double flowers in summer. Woody capsule fruit in summer and fall
Color: Light green foliage; flowers white, pink, lavender, and combinations of colors, July through September

Texture: Medium; semi-coarse twigs
Soil: Medium drainage; medium fertility
Landscaping comments: Very hardy for general use; easy to grow; many cultivars; generally pest-free

FIGURE 22

**Barberry, Japanese**


Yellow Spring Flowers Somewhat Hidden by Foliage
Thorns
Alternate Foliage
Red Berry in Fall
Inside Wood Is Yellow

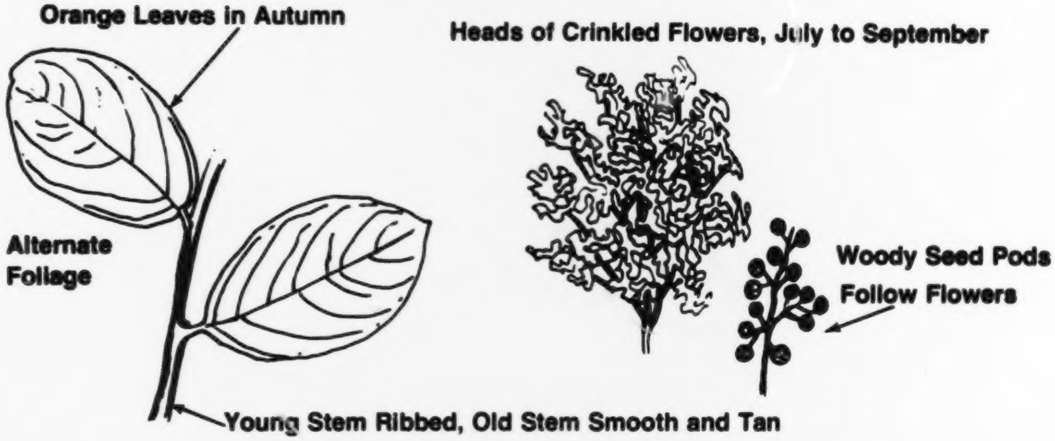
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Barberry, Japanese
Botanical name: *Berberis thunbergi*
Hardiness zone: 3
Exposure: Part shade to shade
Size: Height 3-5 feet; spread 3-5 feet
Form: Globe
Flower: Very small cup-shaped flower; small berry-shaped fruit; spine at each leaf
Color: medium green foliage, red leaf species with maroon-red foliage; creamy-yellow flowers in April and May; orange-red fall fruit
Texture: Medium
Soil: Medium drainage; medium fertility
Pest problems: Root rot in wet locations

Landscaping comments: Useful for various locations; desirable hedge plant—not easily penetrated by people or animals; moderate grower

FIGURE 23

**Crape Myrtle**

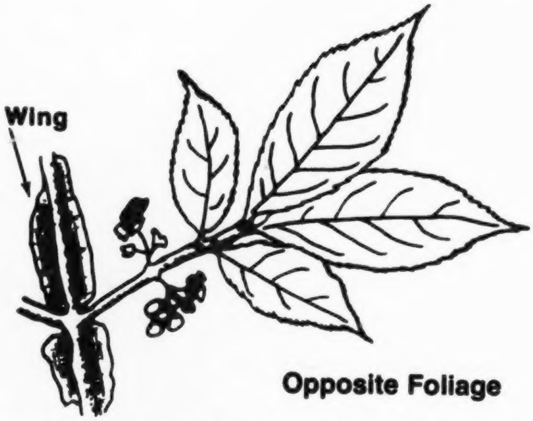

Orange Leaves in Autumn
Heads of Crinkled Flowers, July to September
Alternate Foliage
Woody Seed Pods Follow Flowers
Young Stem Ribbed, Old Stem Smooth and Tan

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Crape Myrtle
Botanical name: *Lagerstroemia indica*
Hardiness zone: 3
Exposure: Sun or part shade
Size: Height 6-20 feet; spread 5-10 feet
Form: Upright
Flower: Clusters or head of flowers July to September; fruit is a rounded woody capsule in late summer and fall
Color: Medium green foliage reddish in fall; white to pink and shades of red and lavender flowers
Texture: Medium
Soil: Medium to good drainage; medium to high fertility
Pest problems: Mildew on sites with sluggish air
Landscaping comments: Wide variation of hardiness in individual plants, generally not a good foliage plant for screening; adaptable for multiple trunk or small tree growth in south and southeast Oklahoma

FIGURE 24

## Euonymus, Winged

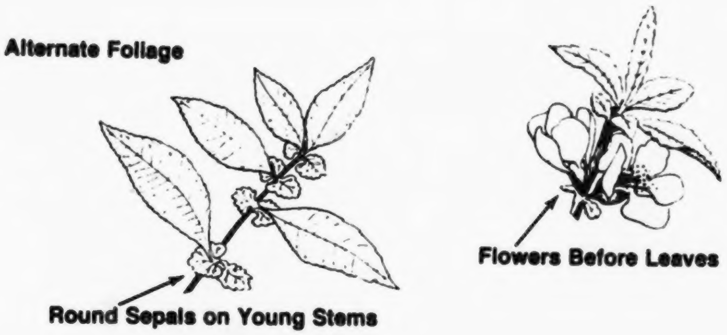


Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Euonymus, Winged
Botanical name: *Euonymus alata*
Hardiness zone: 3
Exposure: Sun to part shade
Size: Height 5-8 feet; spread 3-5 feet
Form: Upright, semi-vase shape to drooping
Flower: Inconspicuous flower in early summer; capsule-like fruit; opposite foliage
Color: Slight mottled green foliage, scarlet in fall in full sun; pink to scarlet fruit pod in fall
Texture: Medium
Soil: Medium drainage; medium fertility
Pest problems: Limited; Scale not generally a problem
Landscaping comments: Fruits are somewhat poisonous if eaten

FIGURE 25

## Flowering Quince



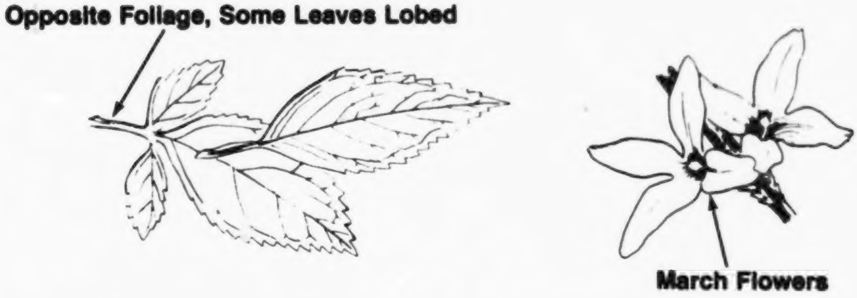
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Flowering Quince
Botanical name: *Chaenomeles speciosa*
Hardiness zone: 4
Exposure: Sun or part shade
Size: Height 5-7 feet; spread 5-7 feet
Form: Semi-globe
Flower: Resembles apple blossoms, blooms with Forsythia in March
Color: Glossy green foliage; rosy red to pink to orange to white flower
Texture: Medium
Soil: Tolerates most soils; chlorotic in alkaline soils
Pest problems: Scales, aphids on new top growth

Landscaping comments: Does well as a sheared hedge; showy in early spring; generally low-maintenance

FIGURE 26

## Forsythia or Golden Bell



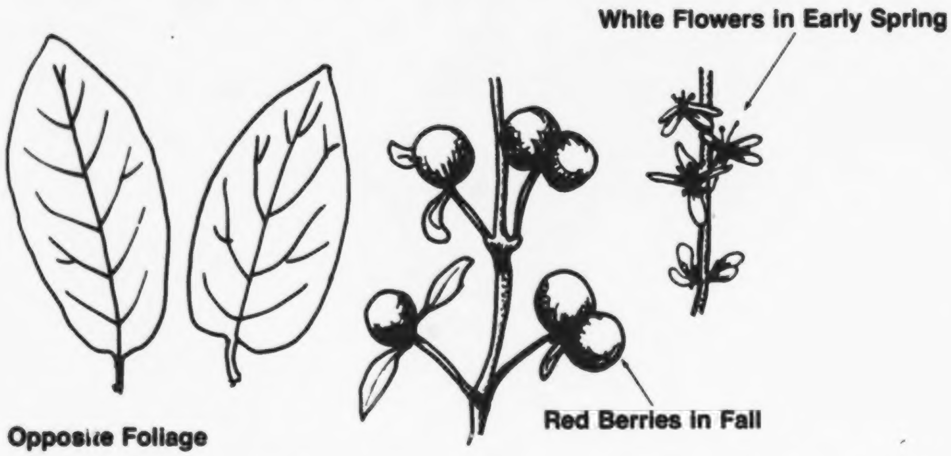
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Forsythia or Golden Bell
Botanical name: *Forsythia intermedia*
Hardiness zone: 5
Exposure: Part shade to shade
Size: Height 6-8 feet; spread 6-10 feet
Form: Irregular and spreading to weeping species
Flower: Bell-shaped individual flowers in very early spring before the leaves appear
Color: Medium green foliage; bright yellow flowers for 10 days to two weeks for which it is grown
Texture: Medium
Pest problems: None serious
Soil: Tolerates almost any soil so long as not dry
Landscaping comments: Subject to drought and winter damage; showy in spring but of limited use in landscape after that; needs pruning

644

FIGURE 27

## Honeysuckle, Tatarian

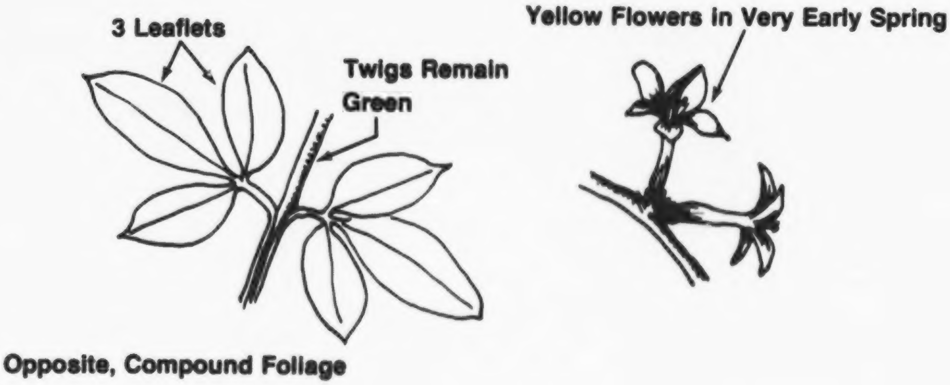


Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Honeysuckle, Tatarian
Botanical name: *Lonicera tatarica*
Hardiness zone: 3
Exposure: Sun or part shade
Size: Height 6-10 feet; spread 6-8 feet
Form: Upright, elongated globe
Flower: Individual, small honeysuckle flowers in May and soft berry in mid to late summer
Color: Blue-green to medium green foliage; deep pink to almost white flower in May; red or yellow berried fruit, depending on cultivar
Texture: Medium
Soil: Medium drainage; medium fertility
Pest problems: None serious
Landscaping comments: Fruit is good attractant for birds; otherwise, too large for average, modern landscape; drought resistant

FIGURE 28

## Jasmine, Winter

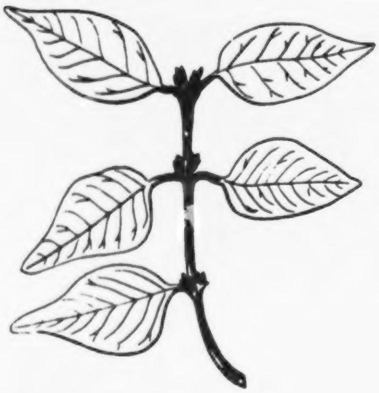

3 Leaflets
Twigs Remain Green
Yellow Flowers in Very Early Spring
Opposite, Compound Foliage

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Jasmine, Winter
Botanical name: *Jasminum nudiflorum*
Hardiness zone: 6
Exposure: Sun or shade
Size: Height 2-4 feet; spread 3-5 feet
Form: Low spreading mound
Flower: Late winter tubular flower in pairs before foliage; fruitless; small compound, opposite foliage
Color: Glossy green foliage; soft yellow flower in February and March
Texture: Medium
Soil: Tolerates poor soils with medium to poor drainage
Pest problems: Bacterial crown gall and stem gall
Landscaping comments: Tough, rugged low shrub; use for hanging down a wall, covering a bank, or massing; twig tips root easily in contact with cultivated soil. Availability very limited. Florida Jasmine, *Jasminum floridum*, is more common in nurseries. It is half-evergreen shrub hardy in Zone 7.

FIGURE 29

## Lilac, Persian



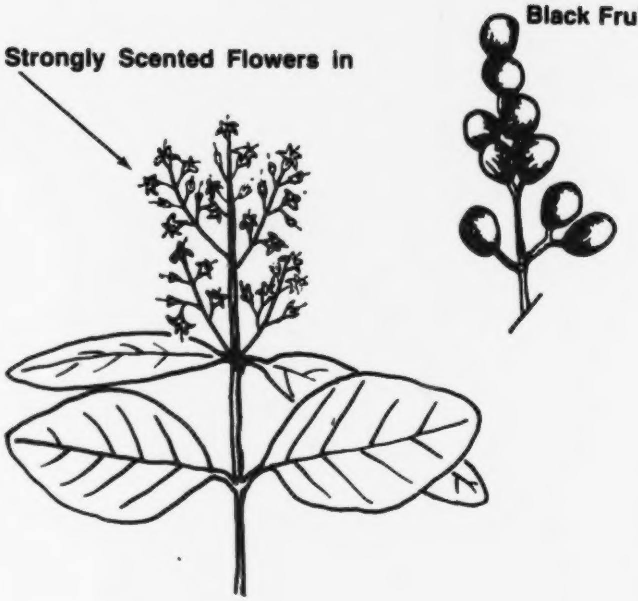
**Opposite Foliage**

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Lilac, Persian
Botanical name: *Syringa x persica*
Hardiness zone: 5
Exposure: Sun or part shade
Size: Height 6-8 feet; spread 7-9 feet
Form: Globe
Flower: Spikes of flowers. Late spring freezes destroy flowers most years in all but northernmost counties
Color: Medium green foliage; lavender pink flower in early April
Texture: Medium
Soil: Almost any with medium to good drainage; medium fertility
Pest problems: Lilac borers; mildew
Landscaping comments: Good foliage and twig growth for screening and background. A long lasting, quality plant with a minimum of problems

FIGURE 30

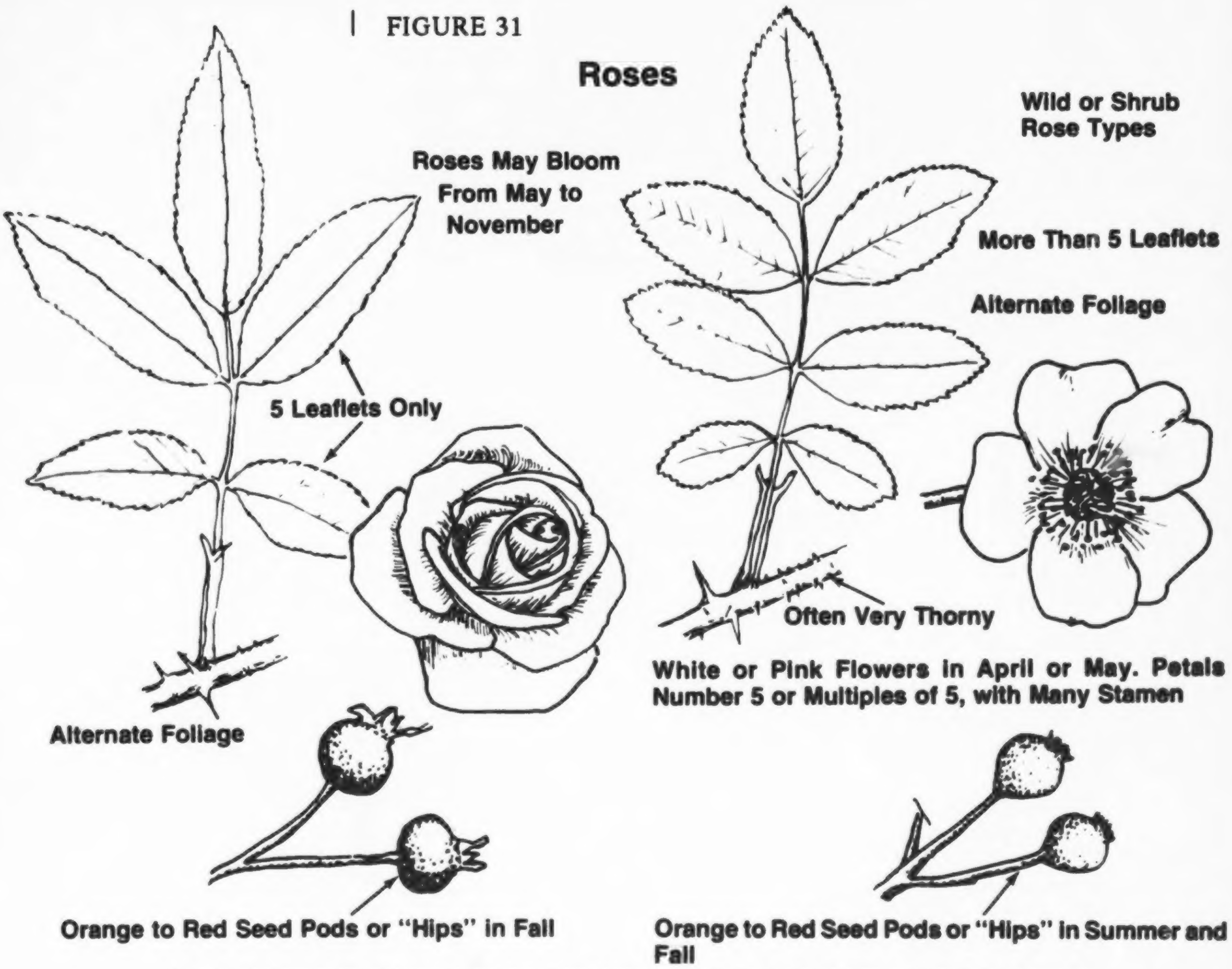
## Privet


Clusters of White, Strongly Scented Flowers in Spring
Black Fruit in Fall. Do Not Eat.

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Privet
Botanical name: *Ligustrum species*
Hardiness zone: 3-7, depending on species
Exposure: Sun or shade
Size: Height 8-12 feet; spread 10-15 feet, unless sheared
Form: Irregular globe to small tree form
Flower: Spikes of small flowers in spring; clusters of fruit in fall
Color: Dark green foliage; semi-evergreen; white flower in May, fragrance may be unpleasant
Texture: Foliage varies from fine to fairly coarse
Soil: Almost any
Pest problems: Spider mites occasionally
Landscaping comments: Privet leaves and seeds may be toxic if eaten; commonly sheared for a hedge

FIGURE 31


Roses
Roses May Bloom From May to November
5 Leaflets Only
Alternate Foliage
Orange to Red Seed Pods or "Hips" in Fall
Wild or Shrub Rose Types
More Than 5 Leaflets
Alternate Foliage
Often Very Thorny
White or Pink Flowers in April or May. Petals Number 5 or Multiples of 5, with Many Stamen
Orange to Red Seed Pods or "Hips" in Summer and Fall

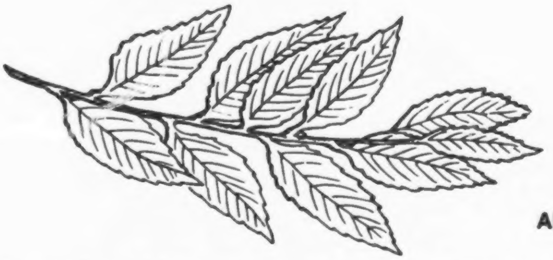
Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Roses
Botanical name: *Rosa species*
Hardiness zone: 4
Exposure: Sun to partial shade; most need one half day sun, preferably in the morning
Size: 10 inches to 10 feet tall and 10 inches to 10 feet spread depending on species and cultivars
Form: Irregular upright or semi-climbing vine. Alternate compound foliage
Flower: Spring or Hybrid perpetual roses bloom only in the spring. Modern roses bloom repeatedly from May to October. Fruit is a fleshy pod called a "hip" usually ripening in autumn

Color: Dark green glossy foliage on most modern roses until frost; flowers vary from white to deepest red and yellow. Often fragrant. Fruit of some species is showy orange
Texture: Medium
Soil: Good loam to clay loam soils
Pest Problems: None to many with some of the modern roses: Aphids, Leaf defoliators, Spider Mites Thrips, Black Spot and Mildew fungus diseases and bacterial crown gall and nematodes
Landscaping comments: Modern roses are high maintenance landscape plants and should be maintained in a special bed.
Cultivars: Hundreds exist

FIGURE 32

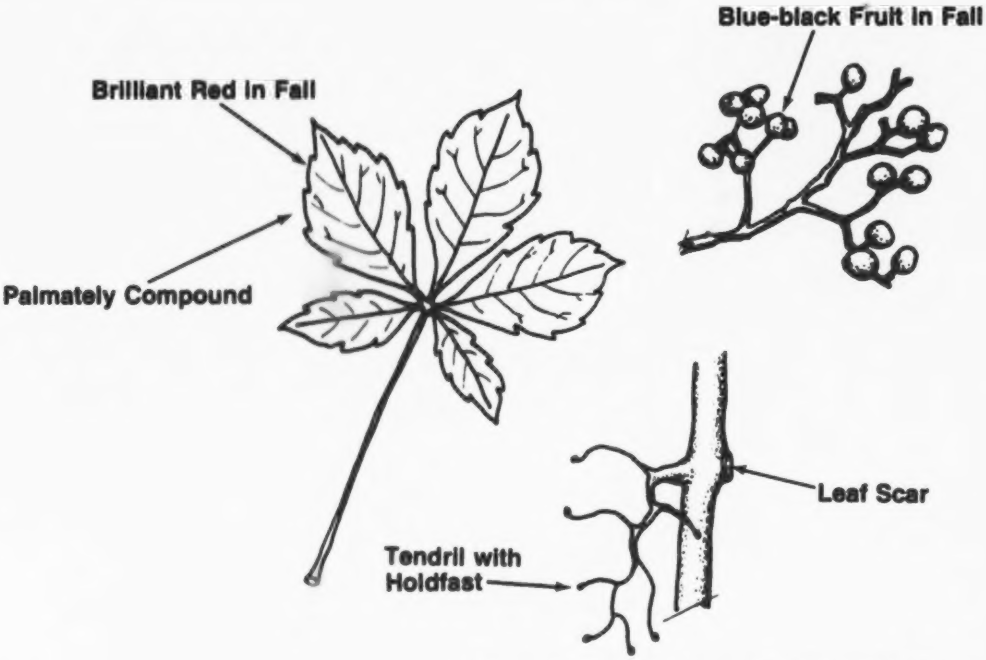
## Spirea, Anthony Waterer



Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Spirea, Anthony Waterer
Botanical name: *Spiraea x bumalda 'Anthony Waterer'*
Hardiness zone: 4
Exposure: Shade or part shade
Size: Height 2-3 feet; spread 18-36 inches
Form: Upright
Flower: Flattened heads of many small flowers on tips of twigs. Inconspicuous fall fruit
Color: Dark green foliage; rose-pink flower in June or July
Texture: Medium
Pest problems: None serious
Soil: Medium drainage; medium fertility
Landscaping comments: Frequently dies out after 5 or 6 years; very showy flowering shrub

## FIGURE 33 Creeper, Virginia


Blue-black Fruit in Fall
Brilliant Red in Fall
Palmately Compound
Leaf Scar
Tendril with Holdfast

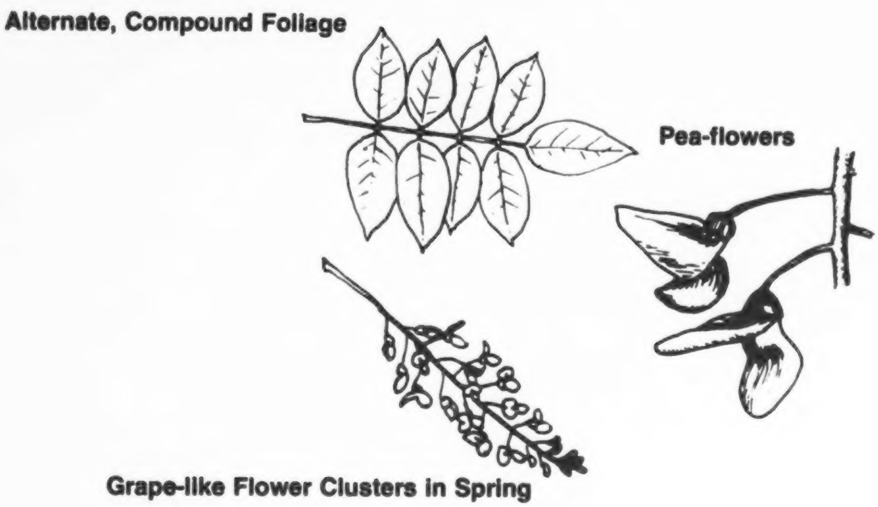
Alternate Foliage, Tendrils Opposite Leaves

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Creeper, Virginia
Botanical name: *Parthenocissus quinquefolia*
Hardiness zone: 2
Exposure: Sun or shade
Size: Grows to 50 feet
Form: Climbing vine with holdfasts
Flower: Inconspicuous spring flower; berried fruit
Color: Dark green foliage, brilliant red in fall
Texture: Medium
Soil: Almost any, medium to poor drainage; medium to high fertility
Landscaping comments: Very good for climbing on shady stone or concrete walls. Also common tree trunks in woods. Do not confuse with Poison Ivy; Virginia Creeper has 5 leaflets

FIGURE 34

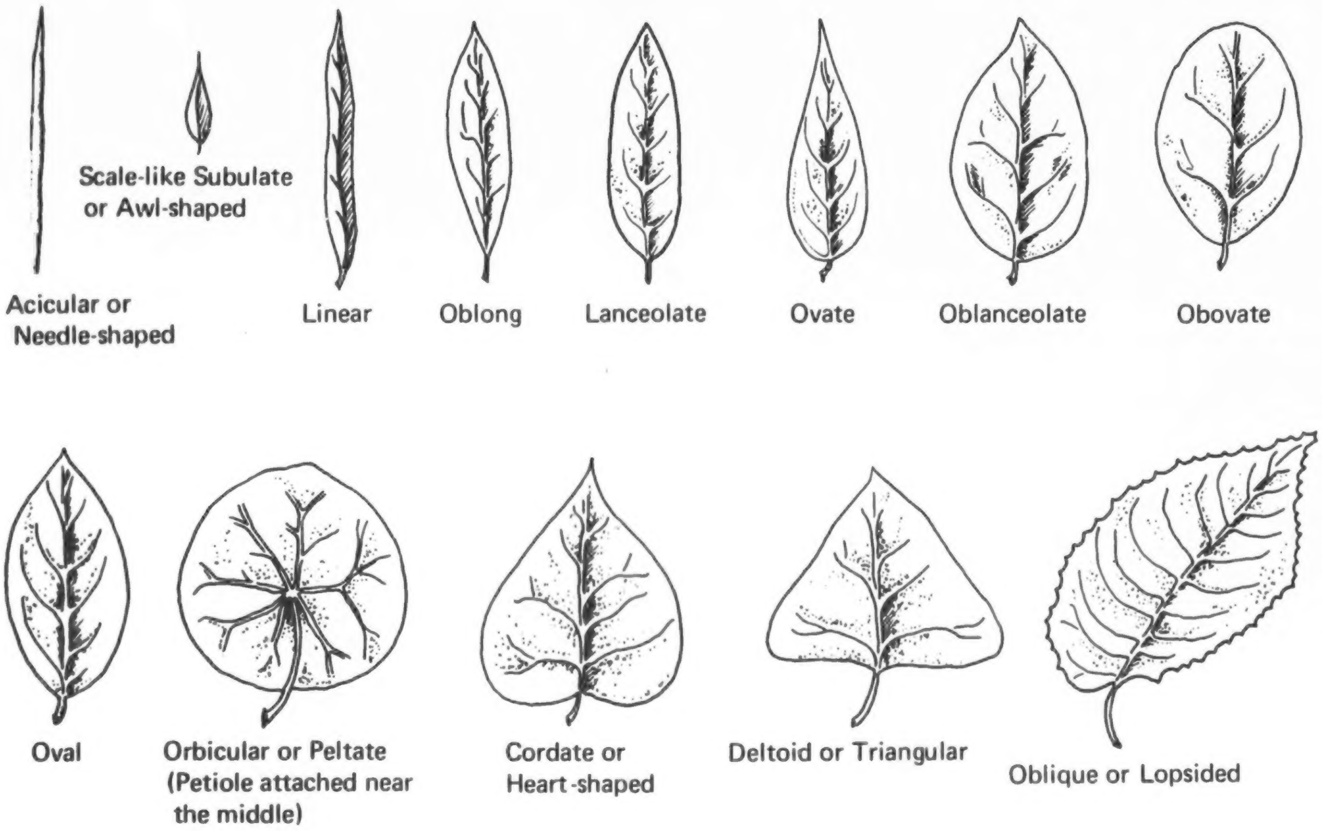
## Wisteria, Chinese


Alternate, Compound Foliage
Pea-flowers
Grape-like Flower Clusters in Spring

Used with permission of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma

Common name: Wisteria, Chinese
Botanical name: *Wisteria sinensis*
Hardiness zone: 5
Exposure: Sun to partial shade
Size: Climbs 10-30 feet by twining
Form: Deciduous vine, very vigorous. Good for covering arbors. Summer shade and winter sun
Flower: Lavender, purple grape-like clusters of fragrant flowers cover the vine in spring
Color: Compound foliage is medium green in summer; yellow in fall
Texture: Medium to coarse
Soil: Any well drained soil. Medium fertility
Pest Problems: Few, if any
Landscaping comments: May need help with strings or soft ties to get started climbing. Transplanted Wisterias are sometimes slow to break dormancy. Buy grafted plants that have flowered. Seed grown Wisterias sometimes do not flower

# COMMON LEAF SHAPES


Acicular or Needle-shaped
Scale-like Subulate or Awl-shaped
Linear
Oblong
Lanceolate
Ovate
Oblanceolate
Obovate
Oval
Orbicular or Peltate (Petiole attached near the middle)
Cordate or Heart-shaped
Deltoid or Triangular
Oblique or Lopsided

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**ACTIVITY SHEET 1**

# INTRODUCTION TO DECIDUOUS PLANTS

# IX

**DIRECTIONS**

Answer the following questions on parts of a botanical name. Use Supplements 2 and 3 or other reference materials, if desired. Write the correct answers in the blanks.

1. What is the botanical name for Green Ash?

   ______________________________

2. What is the genus for Lacebark Elm? ____________

3. What is the species name for Silver Maple?

   ______________________________

4. What is the genus for Water Oak?

   ______________________________

5. What is the meaning of the botanical name for Water Oak?

   ______________________________

6. What is the species name for Redbud?

   ______________________________

7. What is the genus for American Sweetgum?

   ______________________________

8. What is the botanical name of Crape Myrtle?

   ______________________________

9. What is the species name for Tatarian Honeysuckle?

   ______________________________

10. What is the genus for Chinese Wisteria?

    ______________________________

**ACTIVITY SHEET 2**

1. *Fraxius pennsylvanica lanceolata*
2. *Ulmus*
3. *saccharinum*
4. *Quercus*
5. *Nigra means dark, black*
6. *canadensis*
7. *Liquidambar*
8. *Lagerstroemia indica*
9. *tatarica*
10. *Wisteria*

| **ASSIGNMENT SHEET 1** | **INTRODUCTION TO DECIDUOUS PLANTS** | **IX** |
|---|---|---|

NAME ______________________________ SCORE _______

**OBJECTIVE 10** **Identify leaf characteristics of deciduous plants.**

**DIRECTIONS** **Your instructor will give you examples of 10 leaves or branches from the following deciduous plants and shrubs. Fill in the following information about the leaves using the information on leaf characteristics in Supplement 4.**

| Plant name | Leaf shape | Leaf tip | Leaf margin | Leaf venation pattern |
|---|---|---|---|---|
| Lacebark Elm | | | | |
| Weeping Willow | | | | |
| Water Oak | | | | |
| Callery Pear | | | | |
| Purple-leaved Plum | | | | |
| Crepe Myrtle | | | | |
| Rose-of-Sharon | | | | |
| Virginia Creeper | | | | |
| Chinese Wisteria | | | | |
| Redbud | | | | |

| ASSIGNMENT SHEET 2 | INTRODUCTION TO DECIDUOUS PLANTS | IX |
|---|---|---|

NAME ________________________________ SCORE _______

**OBJECTIVE 11**

**Select true statements regarding deciduous plants.** Place a "T" in front of true statements and an "F" in front of false statements.

___ 1. A Flowering Crab Apple has an inconspicuous flower.

___ 2. A Green Ash has inconspicuous flowers.

___ 3. The Bald Cypress is an upright, conical tree.

___ 4. The River Birch grows best in partial shade.

___ 5. The Flowering Dogwood can be easily transplanted.

___ 6. The Lacebark Elm is susceptible to Dutch Elm Disease and Elm Leaf Blight.

___ 7. The Goldenrain Tree has medium-green foliage.

___ 8. The Thornless Honeylocust has a showy spring flower.

___ 9. The Silver Maple grows in almost any soil except poorly drained clay.

___ 10. The Sugar Maple has a hardiness zone of 7.

___ 11. The Oak Pin produces cones in the fall.

___ 12. The Water Oak has male catkins and inconspicuous female flowers.

___ 13. 'Bradford' is a cultivar of the Callery Pear.

___ 14. The Chinese Pistache grows best in shade.

___ 15. The Purple-leaved Plum produces large, edible plums in summer.

___ 16. The Eastern Redbud has inconspicuous flowers in the spring.

___ 17. The Russian Olive is often planted in shelterbelts for wildlife.

___ 18. The American Sweetgum has very little drought resistance.

___19. A Sycamore or American Plane Tree can reach heights of 150 feet and a spread of 100 feet.

___20. A Weeping Willow grows best in heavy clay soils.

___21. An Althea is generally pest-free.

___22. The Japanese Barberry is a creeping vine.

___23. The Crape Myrtle provides a good screen.

___24. The Winged Euonymus often suffers from scale.

___25. A flowering Quince has glossy green foliage.

___26. A Forsythia tolerates almost any soil as long as it is not dry.

___27. The Tatarian Honeysuckle is usually too large for an average, modern landscape.

___28. A Winter Jasmine has a hardiness zone of 6.

___29. The Persian Lilac works well as a screen or for background.

___30. The Privet is rarely used as a hedge.

___31. Most roses are high-maintenance landscape plants.

___32. The Anthony Waterer Spirea has conspicuous fall fruit.

___33. Virginia Creeper climbs by twining.

___34. A Chinese Wisteria is a good plant for covering arbors.

NAME ______________________________ SCORE ______

**OBJECTIVE 12**

Recommend deciduous plants for various landscape situations. Select the trees, shrubs, and vines from Supplement 3. Write your answer in the blank provided.

1. J.J. Smith wants to plant a shade tree in his yard. He specifically wants a tree with no serious pest problems. The area in which the tree will be planted is near a creek and the site gets plenty of moisture. What would you recommend? Which, if any, would you LEAST recommend and why?

   ______________________________________________

   ______________________________________________

   ______________________________________________

2. Terry Barry would like to plant some shrubs that have conspicuous (or showy) flowers during the late summer months. She would like a pest-free shrub that is easy to grow. What would you recommend?

   ______________________________________________

   ______________________________________________

   ______________________________________________

3. Dexter Rose would like a plant that will cover an arbor he had build in his backyard. What would you recommend?

   ______________________________________________

   ______________________________________________

   ______________________________________________

4. Sue Bee wants to plant a hedge around her new home. She doesn't have room for large shrubbery, but wants a hedge that will help keep out the neighbor's pets and children. What would you recommend?

5. Buzz Bush has a contract with the city to plant some trees along Main Street. What should he NOT plant along the street?

**ASSIGNMENT ANSWERS**

# INTRODUCTION TO DECIDUOUS PLANTS

# IX

**ASSIGNMENT SHEET 1**

| Plant name | Leaf shape | Leaf tip | Leaf margin | Leaf venation pattern |
|---|---|---|---|---|
| Lacebark Elm | Ovate | Pointed | Sawtooth or serrate | Pinnate |
| Weeping Willow | Narrowly lanceolate | Pointed | Smooth | Pinnate |
| Water Oak | Obovate (club-shaped) | Rounded | Smooth to slightly wavy | Pinnate |
| Callery Pear | Rounded-oval | Pointed | Irregular sawtooth | Pinnate |
| Purple-leaved Plum | ovate to obovate | Pointed | Serrate or sawtooth | Pinnate |
| Crape Myrtle | elliptical | Rounded to ovate | Smooth | Pinnate |
| Rose-of-Sharon | oval-3 lobes | Pointed | Coarsely toothed | Palmate |
| Virginia Creeper | (leaflets) obovate to egg-shaped | Pointed | Sawtooth | Pinnate (leaflets) |
| Chinese Wisteria | ovate to slightly oblong | Pointed | Smooth | Pinnate |
| Redbud | Heart-shaped | Pointed | Smooth | Pinnate |

## ASSIGNMENT SHEET 2

1. F
2. T
3. T
4. T
5. F
6. F
7. T
8. F
9. T
10. F
11. F
12. T
13. T
14. F
15. F
16. F
17. T
18. T
19. T
20. F
21. T
22. F
23. F
24. F
25. T
26. F
27. T
28. T
29. T
30. F
31. T
32. F
33. F
34. T

## ASSIGNMENT SHEET 3

1. Recommendations could include: Lacebark Elm, Silver Maple, Callery Pear, Chinese Pistache, or Russian Olive. The least recommended would be the Silver Maple because of its brittle wood and root spreading.
2. Recommendations could include: Althea or Rose-of-Sharon, Crape Myrtle (although it could have mildew problems), and 'Anthony Waterer' Spirea.
3. Chinese Wisteria
4. Recommendations could include: Flowering Quince, Japanese Barberry, or Privet; possibly Persian Lilac.
5. Flowering Dogwood, American Sweetgum, and Sycamore or American Plane Tree

**WRITTEN TEST**

# INTRODUCTION TO DECIDUOUS PLANTS

# IX

NAME ______________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with deciduous plants to their correct definitions.** Write the correct letters in the blanks.

___ 1. Plant that bears cones

___ 2. Plant name used by the general public

___ 3. Tolerant and capable of withstanding adverse conditions or pests

___ 4. Small, circular discs at the tips of some tendrils

___ 5. Any plant displayed to its best advantage either alone or in multiple plantings

___ 6. Plants that lose their foliage at the end of the growing season

___ 7. Latin identification of plant materials divided into genus and species

___ 8. A cultivated variety of plant that will retain its distinguishing features when reproduced

___ 9. Not actively growing, but capable of resuming growth when environmental conditions become favorable

___ 10. Plants that keep their foliage year round

___ 11. Usually slender organs on a vine used for climbing; formed by modification of a branch, leaf, or flower stalk

a. Tendrils
b. Catkin
c. Common name
d. Botanical name
e. Cultivar
f. Deciduous
g. Dormant
h. Lanceolate
i. Resistant
j. Blight
k. Acicular
l. Form
m. Generic name
n. Hardiness
o. Twining
p. Forage
q. Specimen plant
r. Bract
s. Conifer

___12. Climbing by using the main stem or branches to wind around an object

___13. The ability of a plant to survive in cold temperatures

___14. A modified leaf at the base of a flower or belonging to a cluster of flowers

___15. A delicate, scaly-bracted, usually drooping spike of flowers

t. Evergreens

u. Holdfasts

**OBJECTIVE 2** **List six features used to identify deciduous plants.**

______________________________________________

______________________________________________

______________________________________________

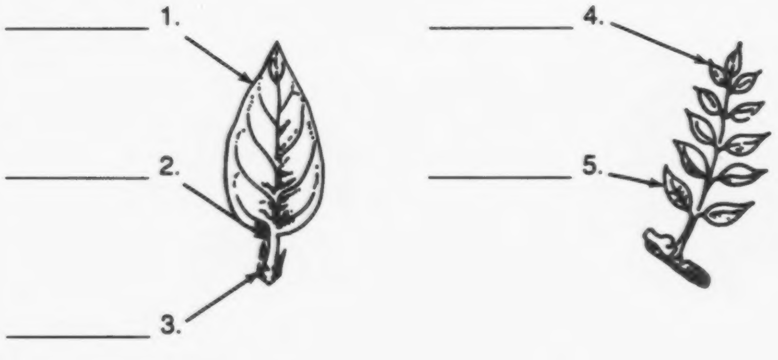
______________________________________________

______________________________________________

______________________________________________

**OBJECTIVE 3** **Describe parts of a leaf of a deciduous plant.** Write the correct names in the blanks.

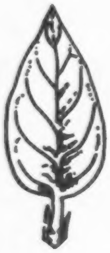
FIGURE 1



**OBJECTIVE 4**

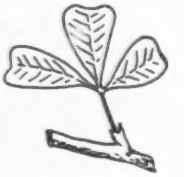
**Describe types of leaves associated with deciduous plants.**
**Write the correct answers in the blanks below the illustrations.**

FIGURE 2



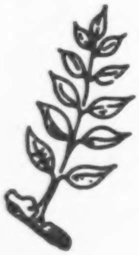
1.____________________

FIGURE 3



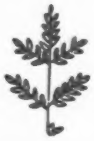
2.____________________

FIGURE 4



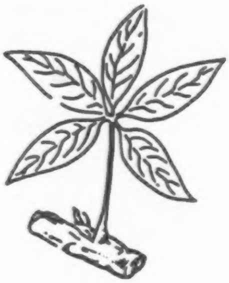
3.____________________

FIGURE 5



4. ____________________

FIGURE 6

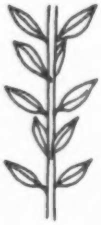


5. ____________________

**OBJECTIVE 5**

**Describe common deciduous leaf arrangements.** Write the correct answers in the blanks below the illustrations.

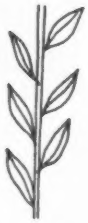
FIGURE 7



1. ____________________

667

FIGURE 8



2.____________________

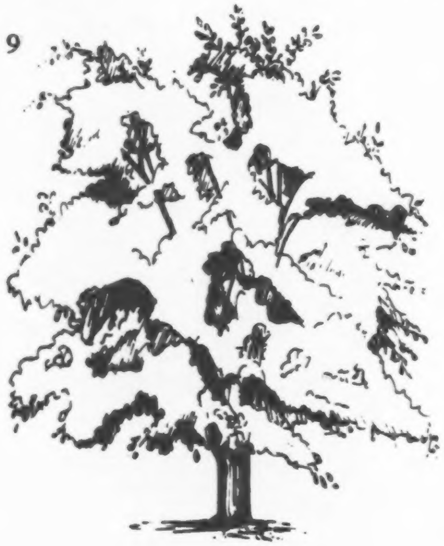
**OBJECTIVE 6** **Describe types of flowers on deciduous plants.** Write the answers in the blanks.

______________________________________________

______________________________________________

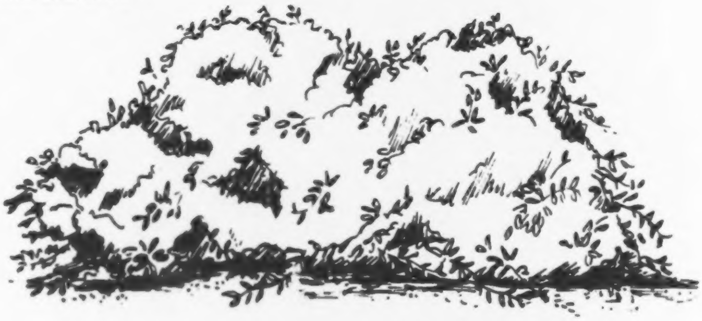
**OBJECTIVE 7** **Label deciduous plant forms.** Write the correct answers in the blanks.

FIGURE 9



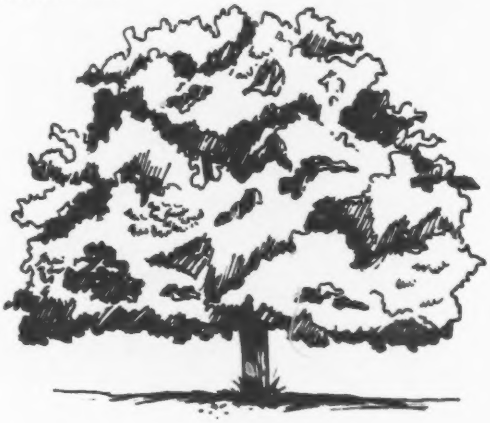
1.____________________

FIGURE 10



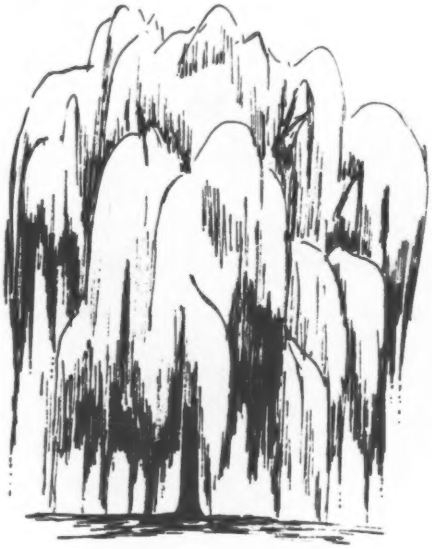
2. ______________________

FIGURE 11



3. ______________________

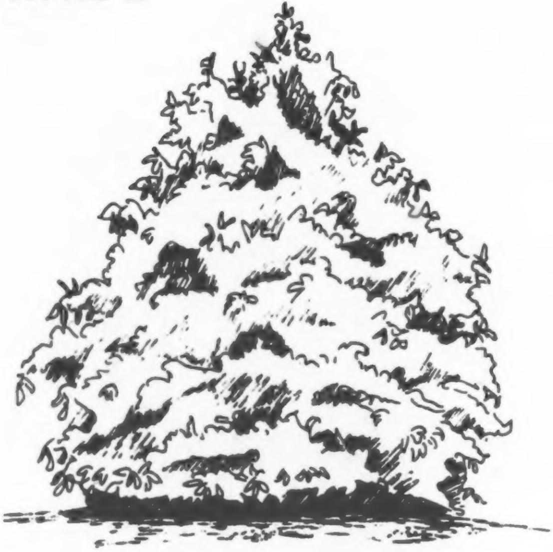
FIGURE 12



4.________________________

670

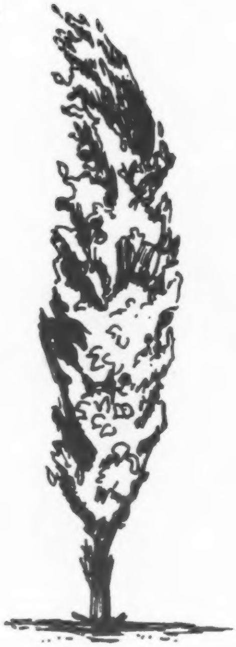
FIGURE 13



5. ____________________

671

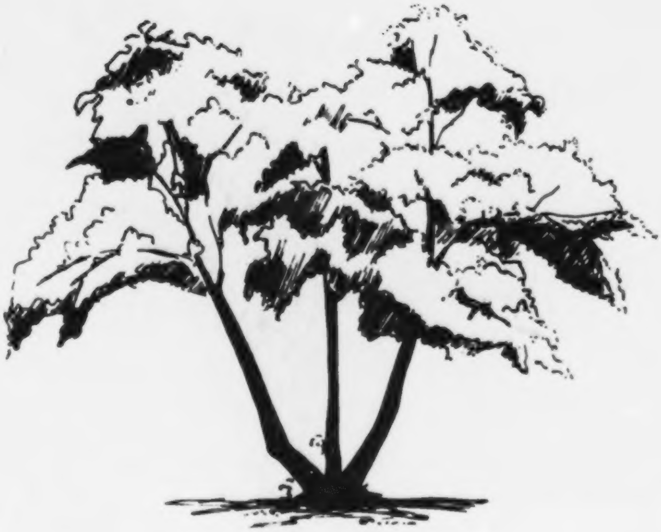
FIGURE 14



6.____________________

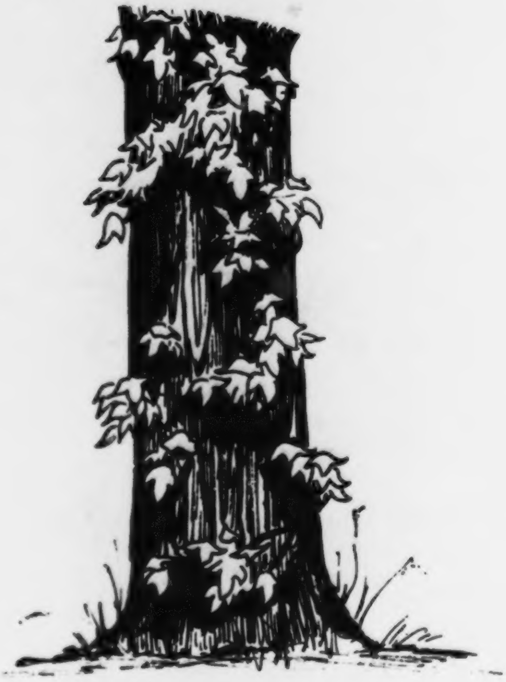
672

FIGURE 15



7. ____________________

FIGURE 16



8. ______________________

**OBJECTIVE**

**List six qualities to consider when selecting deciduous plants for a landscape.**

**OBJECTIVE 9** **List landscape uses for deciduous trees and shrubs. List three uses for trees and three uses for shrubs.**

**Trees**

________________________________________

________________________________________

________________________________________

**Shrubs**

________________________________________

________________________________________

________________________________________

**NOTICE** The following assignment sheets are not part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 10** **Identify leaf characteristics of deciduous plants.** SCORE ________

**OBJECTIVE 11** **Select true statements regarding deciduous plants.** SCORE ________

**OBJECTIVE 12** **Recommend deciduous plants for various landscape situations.** SCORE ________

## WRITTEN TEST ANSWERS

## INTRODUCTION TO DECIDUOUS PLANTS

## IX

**OBJECTIVE 1**

1. s
2. c
3. i
4. u
5. q
6. f
7. d
8. e
9. g
10. t
11. a
12. o
13. n
14. r
15. b

**OBJECTIVE 2**

Answers should include the following

- Flower type
- Fruit type
- Leaf shape and arrangement
- Stem type
- Bark
- Plant shape (form)

**OBJECTIVE 3**

1. Stipules—Secondary growth at the base of a petiole
2. Petiole—Stalk at the base of a leaf (leaf stem)
3. Blade—Expanded, flattened portion of a leaf, attached to the petiole
4. Rachis—Central stem of compound leaves
5. Leaflet—a single division of a compound leaf

**OBJECTIVE 4**

1. Simple—Leaf that is one solid piece; undivided
2. Trifoliate—Having three leaves, leaflets, or leaf-like parts

3. Pinnately compound—Leaf with leaflets arranged opposite each other along the rachis
4. Bi-pinnately compound (twice pinnate)—Leaf with leaflets that are also compound or divided
5. Palmately compound—Leaf divided into sections so that it appears like fingers on a hand

**OBJECTIVE 5**

1. Opposite—Directly across from each other
2. Alternate—Found at different levels along a stem

**OBJECTIVE 6**

1. Conspicuous—Prominent, showy
2. Inconspicuous—Insignificant; not readily seen

**OBJECTIVE 7**

1. Irregular
2. Low, spreading
3. Oval to rounded
4. Weeping
5. Pyramid or conical with a central leader
6. Columnar
7. Multiple trunk
8. vine

**OBJECTIVE 8**

Answer should include six of the following

- Hardiness zone (Climate)
- Exposure
- Size
- Form (or shape)
- Color
- Texture

- Soil requirements
- Insect or pest problems

**OBJECTIVE 9** Answer should include any three of the following for trees and three of the following for shrubs.

Trees

- Provide shade—A tree planted in the right location can keep temperatures in a home cooler and, at the same time, provide shade outdoors
- Frame a house or a view
- Add interest or fill in bareness—Properly placed trees can help soften the sharp lines of a home
- Act as a screen or provide privacy

Shrubs

- Form borders around buildings or along walkways
- Provide a background for a landscape
- Act as a screen or provide privacy
- Provide accent or add interest to a garden or building

**OBJECTIVE 10** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 11** Refer to answers to Assignment Sheet 2.

**OBJECTIVE 12** Refer to answers to Assignment Sheet 3.

**OBJECTIVE SHEET**

# CHEMICAL SAFETY

# X

**INTRODUCTION**

Chemicals used to control pests and unwanted plants are potentially poisonous to humans, animals (particularly to birds and fish), as well as to desirable insects and microorganisms. Knowing about chemical hazards, knowing how to handle chemicals safely and keep yourself, your coworkers and the environment safe is critical to all horticultural occupations.

**UNIT OBJECTIVE**

After completing this unit, the student should know basic chemical types and uses, basic chemical safety, how to safely handle and store chemicals and should be able to clean equipment after using chemical controls. The student will demonstrate these competencies by completing job sheets, practical tests, and written test with a minimum of 85 percent accuracy and a chemical label safety test with 100 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms pertaining to chemical safety to their correct definitions.
2. Select from a list true statements concerning pesticide classifications.
3. Match common types of chemical controls used in horticulture to their correct descriptions.
4. Match the ways chemical controls work to their correct descriptions.
5. Match types of chemical control applications to their correct descriptions.
6. Distinguish between acute and chronic toxicity.
7. Define oral, dermal, and inhalation toxicity.
8. List symptoms of pesticide poisoning to their descriptions.
9. State chemical safety precautions.
10. Complete personal safety precautions for handling chemicals.

11. Complete statements about the importance of protective clothing and equipment.
12. Match pesticide information to a sample pesticide label.
13. Select from a list true statements concerning rules for chemical storage.
14. Select from a list true statements concerning guidelines for hazardous waste disposal.
15. Match types of spray equipment to their correct uses.
16. Select from a list true statements about the information on a hazardous materials classification card.
17. Complete safety test on reading chemical labels with 100 percent competency. (Assignment Sheet 1)
18. Demonstrate the ability to
    a. Clean chemical containers for disposal. (Job Sheet 1)
    b. Clean spray equipment after pesticide use. (Job Sheet 2)
    c. Clean spray equipment after herbicide use. (Job Sheet 3)

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Order materials to supplement unit.
- Obtain OSU Extension Facts regarding pesticides, if not already on file:
  - No. 7451 *Agricultural Pesticide Storage*
  - No. 7453 *First Aid for Pesticide Poisoning**
  - No. 7454 *Check your Pesticide Labels*
  - No. 7457 *Toxicity of Pesticides*

  *Order copies for all students
- Obtain and post appropriate hazardous materials symbols in your area.
- Make or select a bed with desirable and undesirable plants to use as demonstration of selective and nonselective herbicides.
- Obtain sample labels from major chemical manufacturers.
- Order Material Safety Data Sheets (MSDSs) for all commercial chemicals in your department if they are not already on file.
- Invite guests such as an extension agent experienced in chemical controls, hazards and safety; a fire safety education officer; a pesticide manufacturer representative; a poison-control specialist or a physician specializing in treating victims of acute and chronic poisoning to speak to the class.
- Invite a commercial grower to discuss pesticide and chemical use in greenhouse operations.

NOTE: Supply guest speakers with the Objective Sheet, Information Sheet and any other components you want them to cover.

## DELIVERY

### Objectives 1 through 5

- Show films on general herbicide and pesticide safety and their uses in greenhouse and other horticulture operations.
- Discuss with the class your own experiences and knowledge about chemical controls, chemical safety and chemical accidents.
- Review terms and definitions with students.
- Inventory your stock of chemicals and discuss classification, types, how they work and methods of application.
- For Objective 3, distribute Activity Sheet 1—*Identify types of chemical controls used in horticulture*. Select a list of pesticides and herbicides for students to classify or provide catalogs for them to work with.
- For Objective 4, distribute Activity Sheet 2 —*Find examples of Pesticides*. Use catalogs in your classroom to find an example of each way chemicals work to control pests.
- Have students capture insects and place them in jars. Use different types of pesticides on each species. Allow students to observe, record and learn the effects of the different types.
- Demonstrate selective and nonselective herbicides.
- Have a commercial grower, extension agent, or manufacturer representative address class on types, forms, classifications, use and applications of chemical controls.

### Objectives 6 through 8

- Have a physician or a poison-control specialist talk to the class about toxicity, first-aid, treatment and consequences of chemical accidents, chemical misuse or poor handling and storage.
- Refer students to OSU Extension Facts No. 7453, *First Aid for Pesticide Poisoning* and No. 7457, *Toxicity of Pesticides*.
- For Objective 6 distribute Supplement 1—*Poison Control Center Telephone Numbers*.

- For Objective 7 distribute Supplement 2—*Toxicity of Chemical Controls* to explain $LD_{50}$ and $LC_{50}$ and reinforce oral, dermal, and inhalation toxicity.

- Distribute Supplement 3—*Dermal Exposure*, showing comparative rates of dermal absorption for different parts of the body. Relate this information to the need for wearing appropriate protective clothing and equipment.

**Objectives 9 through 13**

- Invite an extension agent or industry representative to discuss label information, MSDS, disposal and proper storage and handling.

- Show videotapes and films on pesticide safety, handling and storing pesticides, reading pesticide labels, hazardous materials disposal and general safety.

- Have students study and compare sample labels of highly hazardous, moderately hazardous and minimally hazardous chemicals.

- For Objective 12, distribute the sample labels in Supplements 4 and 5 and have students complete Assignment Sheet 1—*Complete safety test on reading chemical labels with 100 percent competency.*

- Have students study MSDSs for substances used in your program. Distribute Supplement 6 MSDS Information Checklist so students can determine whether the MSDS contains the essential information. Explain that some MSDS reports are thorough while others provide minimal or incomplete information.

- Demonstrate the use of protective clothing and equipment. Let students try on pieces, including a full suitup to experience the degree of protection and restrictions inherent in using protective gear.

- Review hazardous warning symbols posted in your area.

**Objectives 14 and 15**

- Show videotapes or films on the safe use, handling and cleaning of pesticide application equipment.

- Demonstrate the different types of equipment and discuss safety procedures.

- Guide students through Job Sheets 1, 2 and 3 or as appropriate to your facilities and equipment.

- Allow students to practice job sheet skills before testing.

**Objective 16**

- Review the Hazardous Materials Classification System with the class. Show an actual card or hand out brochures on hazardous communication standards. If no cards are available, locate some on the campus or in the community and refer students to those locations.

## APPLICATION

**Objectives 17 and 18**

- Use Assignment Sheet 1 to test students' ability to read chemical labels and to help them learn the types of information provided on the label. Practice exercises with sample labels can reinforce learning.

- Use Job Sheets to teach the importance of cleaning equipment safely:

  Job Sheet 1—Clean chemical containers for disposal.

  Job Sheet 2—Clean spray equipment after pesticide use.

  Job Sheet 3—Clean spray equipment after herbicide use.

## EVALUATION

**Practical test**

- Determine if student followed correct procedure on each job sheet.

- Evaluate the quality of each product using the criteria given.

- Demonstrate the procedure again and retest if necessary.

**Written test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.

- Give written test.

  **NOTE:** The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.

- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

### Agencies

- Plant Industry Division, Oklahoma Department of Agriculture, 288 N. Lincoln Blvd., Oklahoma City, OK 73105-4298, telephone (405) 521-3864.
- Poison Control Centers—See Supplement 1.
- OSU Extension Facts:

No. 7451 *Agricultural Pesticide Storage*

No. 7453 *First Aid for Pesticide Poisoning*

No. 7454 *Check your Pesticide Labels*

No. 7457 *Toxicity of Pesticides*

*OSU Extension Agents' Handbook of Insect, Plant Disease and Weed Control* Available from Cooperative Extension Service, Division of Agriculture, Oklahoma State University, Stillwater, Oklahoma 74075

### Audiovisual Materials

- *Pesticide Safety in the Greenhouse*. Color VHS, 21 minutes, 1986. Training video on handling horticultural chemicals and compliance with "Right-to-Know" laws. Includes mixing and storing pesticides safely, clothing and equipment safety, accident prevention guidelines, understanding and reading labels, how to handle spills and safe disposal of empty containers.
- *How to Select and Safely Use Herbicides*. Color VHS, 20 minutes, 1989. Includes selecting the right chemical for the job, safe clothing do's and don'ts, how to analyze site and weather conditions, choosing the proper infield equipment, mixing and application methods, non-chemical alternative, record-keeping, signage and container disposal.

- *Working with Pesticides*. Four volumes of pesticide safety. Vol. 1, *Safe Storage & Disposal Methods*, color VHS, 15 min; Vol. 2, *Infield Clothing, Equipment & Environmental Safety*; Vol.3 *Calibrating, Mixing & Applying Pesticides*, Color VHS, 15 min.; Vol. 4, *Sprayer Operation & Maintenance Guidelines*, color VHS, 15 min. Includes pesticide labels, spills, emergencies, how to avoid environmental damage.

  **NOTE:** The above videotapes are available from The Idea Bank 23994, Tempe, AZ 85282, telephone 1-800-621-1136.

## UNIT REFERENCES

- Nesheim, O. Norman. *Agricultural Pesticide Storage*, OSU Extension Facts No. 7451., Stillwater, Oklahoma State University, n.d.
- Nesheim, O. Norman. *First Aid for Pesticide Poisoning*. OSU Extension Facts No. 7453., Stillwater, Oklahoma State University, n.d.
- Nesheim, O. Norman. *Check Your Pesticide Labels*, OSU Extension Facts No. 7454., Stillwater, Oklahoma State University, n.d.
- Nesheim, O. Norman and Criswell, Jim T. *Toxicity of Pesticides*, OSU Extension Facts No. 7457., Stillwater, Oklahoma State University, n.d.
- *Occupational Horticulture, Catalog No. 31B*, 2nd edition. College Station, Texas: Texas A & M University, Instructional Materials Service, 1985.
- Richardson, William B., and Moore, Gary B., *Working in Horticulture*. New York: Gregg Division/McGraw-Hill Book Company, 1980.

**INFORMATION SHEET**

## CHEMICAL SAFETY

**X**

**OBJECTIVE 1**

**Match terms pertaining to chemical safety to their correct definitions.**

- **Applicator**—Person who applies herbicides and pesticides
- **Systemic**—(sis-**tem**-ik) Inside and moving throughout a plant
- **Translocated**—Food materials, pesticide, or herbicide moved from one part of the plant to another

  EXAMPLE: A translocated herbicide can be applied to the leaves and will travel through the plant to the roots, killing the roots.

- **Suspension**—Solid or liquid particles mixed throughout a liquid, but not dissolved in it
- **Emulsion**—Tiny particles of oil suspended in another liquid
- **Reentry**—Returning to a chemically treated area after treatment
- **Drift**—Movement of a chemical to an unintended area

  **NOTE:** Wind is a major cause of drift. Application is difficult to control, so herbicides can accidentally kill desirable plants.

- **Asphyxiation**—(ass-fix-ee-**ay**-shun) Loss of consciousness (passing out) caused by too little oxygen and too much carbon dioxide or other chemical in the blood

  **NOTE:** Breathing the vapors of some chemicals can replace oxygen in the bloodstream, causing asphyxiation and possible brain damage.

- **Toxic**—Poisonous
- **Toxicity**—(tock-**sis**-uh-ty) The ability of a poison to produce adverse effects

  **NOTE:** Effects can range from a slight headache or lightheadedness to convulsions, coma and death.

- **Combustible**—Capable of bursting into flames

- **Acronym**—(ak-ruh-nim) Letters of a name or title that represent the name or title

  EXAMPLE: OSHA is the acronym for Occupational and Health Administration.

- **Nonselective**—Affecting all plants or all parts of plants
- **Selective**—Affecting specific plants or specific parts of plants
- **Potency**—Strength or effectiveness of a chemical

**OBJECTIVE 2**

**Select from a list true statements concerning pesticide classifications.**

- **Class I pesticides**
  a. Highly toxic
  b. Identification symbol: "DANGER" and "POISON" with a skull and crossbones
  c. Poses a threat to humans, animals or the environment, even when used as directed.
  d. Classified as "Restricted Use."

  NOTE: "Restricted Use" means that for private and non-commercial use, the applicator (person using the chemical) must be trained and pass certification tests to use Class I pesticides. Commercial applicators are required to be certified regardless of the classification of pesticide used.

- **Class II pesticides**
  a. Moderately toxic
  b. Identification symbol: "WARNING"
  c. Poses a threat to humans or the environment, even when used as directed.
  d. May be classified as "Restricted Use."

- **Class III**
  a. Slightly toxic
  b. Identification symbol: "CAUTION"

c. Not likely to harm humans and the environment when used as directed.

NOTE: Some Class III pesticides, such as Dimilin, are restricted-use pesticides because of their effect on the environment.

- **Class IV**

a. Relatively non-toxic

b. Identification symbol: "CAUTION"

**OBJECTIVE 3**

**Match common types of chemical controls used in horticulture to their correct descriptions.** (Activity Sheet 1)

- **Selective pesticide**—Kills some pests while not affecting others

NOTE: Certain chemicals are harmful to certain plants. Dangers are listed on the label.

- **Nonselective pesticide**—Kills all pests
- **Insecticide**—Used against insects
- **Fungicide**—Used against fungi

NOTE: Fungus includes molds, mildews, rusts, smuts, mushrooms, toadstools, and yeast. Some soil fungi are essential for healthy soil. Fungus on roots, stems, leaves, or flowers can cause plant disease.

- **Bactericide**—Used against bacteria

NOTE: Bacteria are microorganisms, so small they can be seen only with a microscope. Some bacteria, such as actinomycetes (ak-tin-oh-my-CEE-tees) are valuable and important to healthy soil. Bacteria on roots, leaves, stems, or flowers can cause plant disease.

- **Herbicide**—Selective or nonselective material for killing weeds or preventing weed seed germination
- **Nematicide**—Destroys nematodes

NOTE: Nematodes, or eel worms, are insects 1/125 of an inch long that attack plant roots. They feed on the root and lay their eggs in it, causing knots to form. The plant loses nourishment from the roots and dies.

- **Miticide**—Destroys mites

  NOTE: Mites are tiny spiders that feed on the undersides of leaves. They are also called red spider mites.

- **Acaricide**—Destroys or repels spiders, mites and ticks
- **Avicide**—Kills or repels birds that harm or destroy crops
- **Rodenticide**—Kills small rodents that feed on crops or seeds

  EXAMPLES: Mice, gophers, moles

- **Pyrethrum**—Insecticide made from dried, powdered chrysanthemum flowers

  NOTE: The organic (natural) forms found in pesticides are called pyrethrins; the synthetic (manufactured) forms are called pyrethroids.

- **Growth regulators**—Specific or nonspecific controls to retard growth, pinch buds, suppress fruiting and flowering, or accelerate growth and flowering

  NOTE: Growth retardants enable growers to produce plants to any height. Used as a chemical pinching agent, a growth retardant can stop growth at the tip, forcing side shoots to produce more buds and, as a result, more flowers per plant. Regulators are also used to create compact plants for shipping. Regulators that speed growth are used to increase hybrid seed production, to force bromeliads to flower, to speed ripening of tomatoes, and to stimulate lateral branching of certain plants.

**OBJECTIVE 4** **Match the ways chemical controls work to their correct descriptions.** (Activity Sheet 2)

- **Stomach poison**—Kills when swallowed
- **Contact poison**—Kills the whole organism when the chemical touches any part of it
- **Fumigant**—Kills when inhaled or absorbed
- **Translocated herbicide**—Kills plants when absorbed by any part of the plant
- **Systemic**—Kills pest when introduced into system of the host, without damaging the host

NOTE: A pesticide can be added to the soil and then absorbed by the roots. It is carried to the leaves and will kill aphids or mites that eat the plant. The plant is not harmed by the pesticide.

- **Protectant**—Prevents pest entry or damage; can also be a repellent
- **Sterilant**—Keeps pests from reproducing or soil from supporting plant life
- **Defoliant and desiccant**—Causes plants to lose foliage

NOTE: Pesticide desiccants can also be used to control insects.

**OBJECTIVE 5** **Match types of chemical control applications to their correct descriptions.**

- **Liquid**
  - **Liquid concentrate**—Mixed with water and applied by hand-pumped spray bottle, compressed air sprayer, fogger, or pressurized can
  - **Solution (S)**—Ready to apply; does not require mixing with water
  - **Emulsifiable concentrate (EC)**—Oil based, mixed with water
  - **Flowable (F)**—Highly-concentrated thick liquid mixed with water to form a suspension
  - **Fumigant**—Turns to gas when applied, may be packaged in pressurized cans
- **Dry**
  - **Dust (D)**—Applied dry; active ingredient is a fine powder
  - **Granules (G)**—Applied dry; particles are much larger than dust
  - **Wettable powder (W or WP)**—Dust-like powder is mixed with water and applied wet; must be constantly stirred or agitated to remain in suspension
  - **Soluble powder (SP)**—Powder that dissolves easily in water

- **Bait**—Granules, tablets, or some other substance containing pesticide

OBJECTIVE 6

**Distinguish between acute and chronic toxicity.**
(Supplement 1)

- Acute toxicity refers to how poisonous a chemical is after one exposure. Acute poisoning can occur after a single small or large exposure. Symptoms develop quickly, within a few minutes or within a few hours.
- Chronic or cumulative toxicity refers to how poisonous a chemical is after repeated small doses. Chronic poisoning occurs over a period of time. Symptoms may appear within a week or toxic buildup can take many years before symptoms appear. People who load chemical products, work in the same building with toxic materials, mix chemicals or work in chemically treated fields can develop chronic toxicity.

OBJECTIVE 7

**Define oral, dermal and inhalation toxicity.**
(Supplements 2 and 3)

- **Oral toxicity**—Poisoning in or through the mouth

  NOTE: We usually think of oral toxicity as eating or drinking a poison. You wouldn't eat or drink pesticides or herbicides. But pesticides on your hands can get into your system through your mouth. That's why the safety precautions say "Don't eat, drink or smoke while handling chemicals."

- **Dermal toxicity**—Poisoning on or through the skin

  NOTE: Pesticides and other poisons are absorbed into your body through your skin whenever the chemical comes in contact with your body. When you get chemicals on your clothes, they hold the chemical next to your skin. You are at risk for dermal poisoning whenever chemicals splash or drip onto your skin.

- **Inhalation toxicity**—Poisoning by breathing in fumes o particles

  NOTE: Inhalation toxicity is especially dangerous because the toxin goes to your lungs, is carried directly into your bloodstream and then to your brain. You may not be able to smell fumes or vapors and may not know you are inhaling them until you get dizzy, sick to your stomach, or pass out.

**OBJECTIVE 8**

**List symptoms of pesticide poisoning.**

These symptoms occur with herbicides and with some pesticides. Symptoms of pesticide poisoning are so varied that no good overall description is possible.

**NOTE:** In the event of poisoning, get immediate medical attention or call a poison control center. Have the label with you when you report to the poison control center or the doctor.

- **Mild poisoning**—Irritation of the skin, nose, throat, and eyes; weakness, dizziness, headache, nausea, diarrhea
- **Moderate poisoning**—Difficult breathing, blurred vision, rapid pulse, flushed skin, stomach cramps, vomiting, muscle twitches, poor muscle coordination, constricted pupils
- **Severe poisoning**—Convulsions, loss of consciousness, secretions from nose and mouth, inability to breathe, often accompanied by fever; MAY BE FATAL

**OBJECTIVE 9**

**State chemical safety precautions.**

- **Follow all directions on the label.** Chemical application can be dangerous. Misuse can cause personal injury and kill nonthreatening animals, or beneficial insects and soil microorganisms. Some chemicals are effective only when applied within the temperature range listed on the label.
- **Do not spray outdoors on windy days.** Drift wastes chemicals and can harm other plants.

  WARNING **If a light breeze comes up, apply chemicals from the windward side of the area being treated, so the breeze will blow the chemical away from you, not onto you.**

- Spray chemicals away from animals and humans. Even if people or animals are not in the immediate area, drift can expose them to toxic materials.
- Do not apply chemicals near water sources, nor near rainfall or irrigation runoff. Pollution from chemical controls can kill fish and poison the water supply.

  NOTE: Runoff carries the chemical from hillsides to small creeks and streams, and on to larger bodies of water.

- **Check label for reentry and harvest regulations**

  NOTE: If the label reads, "Reentry 8 days," workers must wear protective clothing and equipment, stay out of the field, or must not come into contact with treated foliage for that period. Reentry time may be as short as 2 days, or as long as 30 days or more.

  Harvest regulations will read, "Do not apply within ______ days of harvest," and may list the required time by crop. Time lapse may be as short as 1 day or as long as 80 days.

- **Mix chemicals outdoors or in a well-ventilated area.** Poisoning, asphyxiation, brain or skin damage can occur as result of breathing chemical fumes.

- **Avoid pressure-release fumes or contact with the material.** When opening containers, lean body and face away from the container.

- **Use the proper amount of chemical.** Overapplication can harm or burn crops, underapplication is ineffective.

- **Do not mix chemicals unless allowed by label directions.** Some chemicals will cancel the effects of others; chemical reactions can burn or harm plants, animals and beneficial insects.

- **Keep records of all injuries.** Written records of chemically-related injuries are necessary for insurance, legal purposes, and for determining use patterns.

  NOTE: Individuals may react to certain chemicals. Records of injuries and reactions can reveal patterns that indicate the individual should avoid those specific chemicals.

- **Provide proper storage.** State and federal regulations govern proper storage. Proper storage will also help avoid contamination and spoilage. (See Objective 12)

**OBJECTIVE 10** **Complete personal safety precautions for handling chemicals.**

- Wear protective clothing as needed
- Never smoke, eat or drink while handling chemicals
- Wash all exposed body surfaces with soap and water immediately after handling chemicals

- If chemicals are spilled onto clothing, remove clothing immediately and wash exposed skin with soap and water

  **CAUTION: Dispose of contaminated clothing.**

- Avoid inhaling sprays, dusts or vapors.

  **NOTE:** If toxin is inhaled, get to fresh air immediately.

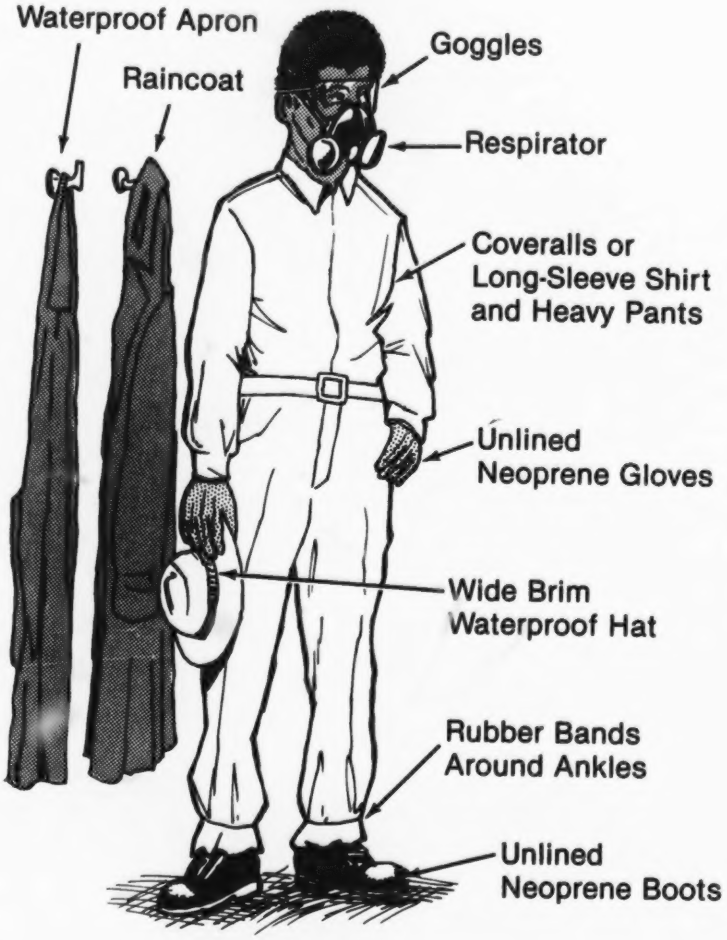
- If chemical gets into eyes, flush eyes with water for 10-15 minutes and get medical attention
- If chemicals are accidentally swallowed get immediate medical attention or call a poison control center; have chemical label by the phone or take label to the doctor or hospital
- If illness or other reaction occurs shortly after chemical use, get immediate medical attention or call a poison control center; have chemical label by the phone or take it to the doctor or hospital

**OBJECTIVE 11**

**Complete statements about the importance of protective clothing and equipment.**

**NOTE:** Directions on the product label will specify protective clothing required. Spraying highly or moderately toxic materials in the greenhouse requires a full protective suit, including air supply. Only certified applicators can apply restricted use chemicals.

FIGURE 1


Waterproof Apron
Raincoat
Goggles
Respirator
Coveralls or Long-Sleeve Shirt and Heavy Pants
Unlined Neoprene Gloves
Wide Brim Waterproof Hat
Rubber Bands Around Ankles
Unlined Neoprene Boots

- **Overalls or long-sleeved shirt and long pants**—Prevents contact with the skin

  NOTE: Pants should be worn outside the boots and fastened with rubber bands.

- **Raincoat or waterproof apron**—Prevents wet-application materials from soaking into clothing and contacting skin

- **Hard hat or waterproof hat**—Protects scalp from contamination

- **Boots of unlined neoprene**—Protects feet and ankles

  NOTE: Lining can absorb a chemical and hold it next to the skin. Some labels do not recommend neoprene. Also, neoprene or other non-cloth clothing are hot to wear.

- **Gloves of unlined neoprene**—Gloves must be long enough to protect wrists; shirt cuffs should be worn outside gloves so that chemicals will not be absorbed in the cloth and contact skin

  NOTE: Neoprene gloves can be cleaned with soap and water or a neutralizing chemical.

- **Goggles or face shield**—Protects eyes and face from chemical burn

- **Respirator**—Protects lungs from chemical burn and protects applicator from possible brain damage

  NOTE: Respirators must be approved by Mining Enforcement and Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH).

**OBJECTIVE 12** **Match pesticide information to a sample pesticide label.** (Assignment Sheet 1, Supplements 4 and 5)

- Trade or brand name (1)
- Common name (2)

  EXAMPLES: Dodeporph acetate, malathion, diazanon
- Chemical name (3)

  NOTE: The chemical name indicates the chemical composition of the active ingredient
- Ingredient statement (4)
- Net contents (5)
- Name and address of manufacturer (6)
- Registration and establishment numbers (7)
- Use classification (8)

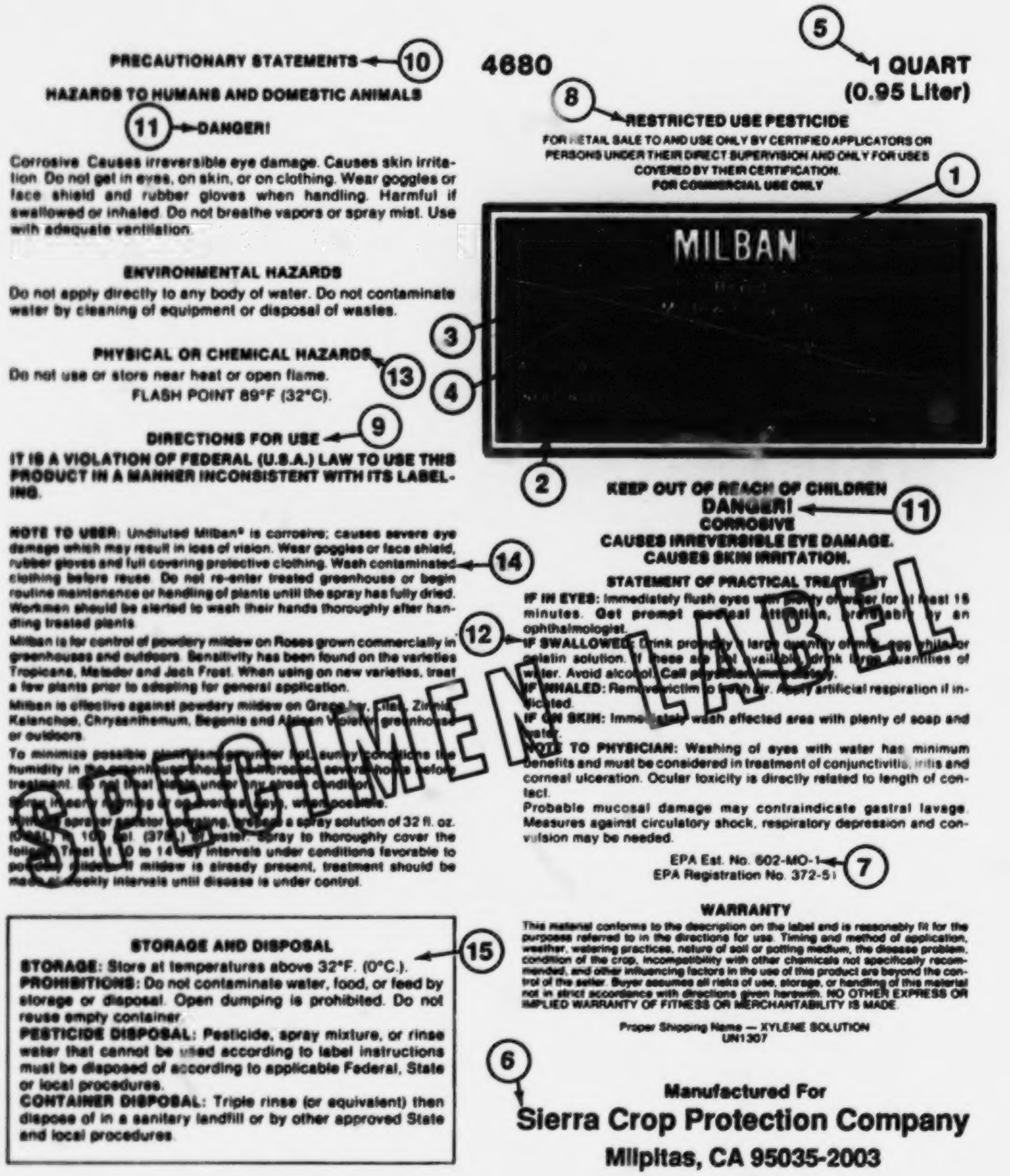
  EXAMPLE: General, Restricted

  NOTE: The certification, or use classification, is often not listed on the label if it is not "restricted use."
- Directions for use (9)
- Precautionary statement (10)

  NOTE: Alerts applicators to hazards to themselves, children, animals and the environment.
- Signal words and symbols (11)

  EXAMPLES: DANGER, WARNING, CAUTION, POISON
- Statement of practical treatment (12)

  NOTE: Includes antidote information for physician or poison control center. Highly toxic chemicals are required to have a statement of practical treatment. Less toxic pesticides will also provide first-aid instructions.
- Physical or chemical hazards (13)
- Reentry statement (14)
- Storage and disposal directions (15)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MILBAN
SPECIMEN LABEL

**PRECAUTIONARY STATEMENTS**

**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

**DANGER!**

Corrosive. Causes irreversible eye damage. Causes skin irritation. Do not get in eyes, on skin, or on clothing. Wear goggles or face shield and rubber gloves when handling. Harmful if swallowed or inhaled. Do not breathe vapors or spray mist. Use with adequate ventilation.

**ENVIRONMENTAL HAZARDS**

Do not apply directly to any body of water. Do not contaminate water by cleaning of equipment or disposal of wastes.

**PHYSICAL OR CHEMICAL HAZARDS**

Do not use or store near heat or open flame.

FLASH POINT 89°F (32°C).

**DIRECTIONS FOR USE**

**IT IS A VIOLATION OF FEDERAL (U.S.A.) LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.**

**NOTE TO USER:** Undiluted Milban® is corrosive; causes severe eye damage which may result in loss of vision. Wear goggles or face shield, rubber gloves and full covering protective clothing. Wash contaminated clothing before reuse. Do not re-enter treated greenhouse or begin routine maintenance or handling of plants until the spray has fully dried. Workmen should be alerted to wash their hands thoroughly after handling treated plants.

Milban is for control of powdery mildew on Roses grown commercially in greenhouses and outdoors. Sensitivity has been found on the varieties Tropicana, Matador and Jack Frost. When using on new varieties, treat a few plants prior to adopting for general application.

Milban is effective against powdery mildew on Grape Ivy, Lilac, Zinnia, Kalanchoe, Chrysanthemum, Begonia and African Violets in greenhouses or outdoors.

To minimize possible [illegible] under hot, sunny conditions the humidity in the [illegible] several hours before treatment. [illegible] under any stress conditions.

[illegible] when possible.

[illegible] a spray solution of 32 fl. oz. [illegible] 100 gal. (378 L) [illegible] water. Spray to thoroughly cover the foliage. Treat at 10 to 14 day intervals under conditions favorable to [illegible] mildew. If mildew is already present, treatment should be made at weekly intervals until disease is under control.

**STORAGE AND DISPOSAL**

**STORAGE:** Store at temperatures above 32°F. (0°C.).
**PROHIBITIONS:** Do not contaminate water, food, or feed by storage or disposal. Open dumping is prohibited. Do not reuse empty container.
**PESTICIDE DISPOSAL:** Pesticide, spray mixture, or rinse water that cannot be used according to label instructions must be disposed of according to applicable Federal, State or local procedures.
**CONTAINER DISPOSAL:** Triple rinse (or equivalent) then dispose of in a sanitary landfill or by other approved State and local procedures.

**4680**

**1 QUART**
**(0.95 Liter)**

**RESTRICTED USE PESTICIDE**

FOR RETAIL SALE TO AND USE ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION AND ONLY FOR USES COVERED BY THEIR CERTIFICATION.
FOR COMMERCIAL USE ONLY

**MILBAN**

**KEEP OUT OF REACH OF CHILDREN**
**DANGER!**
**CORROSIVE**
**CAUSES IRREVERSIBLE EYE DAMAGE.**
**CAUSES SKIN IRRITATION.**

**STATEMENT OF PRACTICAL TREATMENT**

**IF IN EYES:** Immediately flush eyes with plenty of water for at least 15 minutes. Get prompt medical attention, preferably by an ophthalmologist.
**IF SWALLOWED:** Drink promptly a large quantity of milk, egg white or gelatin solution. If these are not available, drink large quantities of water. Avoid alcohol. Call physician immediately.
**IF INHALED:** Remove victim to fresh air. Apply artificial respiration if indicated.
**IF ON SKIN:** Immediately wash affected area with plenty of soap and water.
**NOTE TO PHYSICIAN:** Washing of eyes with water has minimum benefits and must be considered in treatment of conjunctivitis, iritis and corneal ulceration. Ocular toxicity is directly related to length of contact.
Probable mucosal damage may contraindicate gastral lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

EPA Est. No. 602-MO-1
EPA Registration No. 372-51

**WARRANTY**

This material conforms to the description on the label and is reasonably fit for the purposes referred to in the directions for use. Timing and method of application, weather, watering practices, nature of soil or potting medium, the disease problem, condition of the crop, incompatibility with other chemicals not specifically recommended, and other influencing factors in the use of this product are beyond the control of the seller. Buyer assumes all risks of use, storage, or handling of this material not in strict accordance with directions given herewith. NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY IS MADE.

Proper Shipping Name — XYLENE SOLUTION
UN1307

**Manufactured For**
**Sierra Crop Protection Company**
**Milpitas, CA 95035-2003**

Used with permission of Sierra Crop Protection Company, Milpitas, CA

BEST COPY AVAILABLE

**OBJECTIVE 13**

**Select from a list true statements concerning rules for chemical storage.** (Supplements 5, 6, and 7)

- Store chemicals in original containers

  NOTE: If containers break or leak, change to a sturdy, sealable container and label immediately.

- Store chemicals in safe, dry areas
- Store chemicals in well-ventilated area
- Keep chemicals labeled and sealed
- Store herbicides, fungicides, insecticides, etc., in separate locations within the storage area

  NOTE: Contamination can occur among different chemicals. Separate storage areas will also help prevent accidental use of unintended products.

- Keep hazardous chemicals in a locked room or cabinet

  NOTE: Hazardous materials warning should be posted on the door so applicators can protect themselves from exposure.

- Location of stored chemicals must be on file with the fire department

  NOTE: In schools, the location of stored hazardous chemicals must be given to the school custodian.

- Store all chemicals out of reach of children and animals
- Never store chemicals near food (animal or human), medicine, or cleaning supplies
- Dispose of leaking containers and old chemicals

  NOTE: Follow specific label instructions.

- Vent hazardous chemical storage cabinets to the outside
- Post proper warning signs
- Don't accept chemicals without their MSDSs

NOTE: MSDS is an acronym for Materials Safety Data Sheet. It must be requested from the manufacturer. The MSDS lists hazards, chemical composition, antidotes, chemical stability, and other factors. The amount of information provided can vary from a single page to 10 or more pages, depending on the manufacturer.

**OBJECTIVE 14** **Select from a list true statements concerning guidelines for hazardous waste disposal.**

- Follow disposal instructions on container
- When instructions are to bury surplus, drain tank in a pit dug in sandy soil away from water sources
- Mix only what is needed to avoid disposal of surplus chemicals
- Do not dispose of empty containers or surplus chemicals where they may be a hazard to fish or wildlife or contaminate water
- Do not save or reuse empty chemical containers
- Clean empty containers thoroughly

  NOTE: Containers for liquid pesticides should be triple rinsed before disposal.

- Dispose of containers promptly

  NOTE: Empty containers should be wrapped in heavy layers of newspaper and kept in a locked room until just before trash pickup.

**OBJECTIVE 15** **Match types of spray equipment to their correct uses.**

NOTE: All the sprayers in this section can be used to apply pesticides, fungicides, bactericides, and growth regulators. Herbicide application is more specialized. Misters and foggers are not used for herbicides because drift is highly likely and will kill surrounding plants. Furthermore, it is practically impossible to remove all herbicide from hoses and containers. Once a sprayer has been used with herbicide, it is never used for spraying crops, ornamental plants or shrubs because residual (left-over) herbicides can kill desirable plants.

**Manually-operated sprayers**

- Aerosol—Used for spot treatments and homeowner applications

NOTE: Aerosol sprayers usually come in pressurized spray cans. They are not economical for professional use.

- Hose end sprayer—Used for low chemical-water ratio applications
- Compressed air—Used for larger areas and for high chemical-water ratio applications; available in canister or backpack models

  NOTE: High chemical-water ratio means a highly concentrated chemical or a large amount of chemical mixed with water. A low chemical-water ratio means a weaker solution.

### Power-operated sprayers

- Commercial lawn sprayers—Used to cover large outdoor areas; can be gasoline or electric, pull-type, self-powered or mounted on skids and carried in the bed of a pickup

  NOTE: Sprayers are available in several sizes, ranging from portable 12-gallon units for greenhouses and nurseries to 30- and 55-gallon units and up to 300-gallon high-pressure models.

- High-pressure sprayers—Type of commercial lawn sprayer; breaks spray into a fine mist; gasoline-powered, carried on or towed by a truck; not used for herbicides
- ULV (Ultra-low volume) sprayers—For greenhouse use; sprays a fog; applies super-concentrated materials without much water; economical to use
- Portable electric sprayers—For greenhouse use; pressure sprayer with a pump; adjustable nozzles for spraying a fine mist to a high-pressure jet stream

- Back pack mist blower—Sprays a mist; used for high concentrate applications; allows applicator to travel through the greenhouse or outside areas; not used for herbicides

FIGURE 2

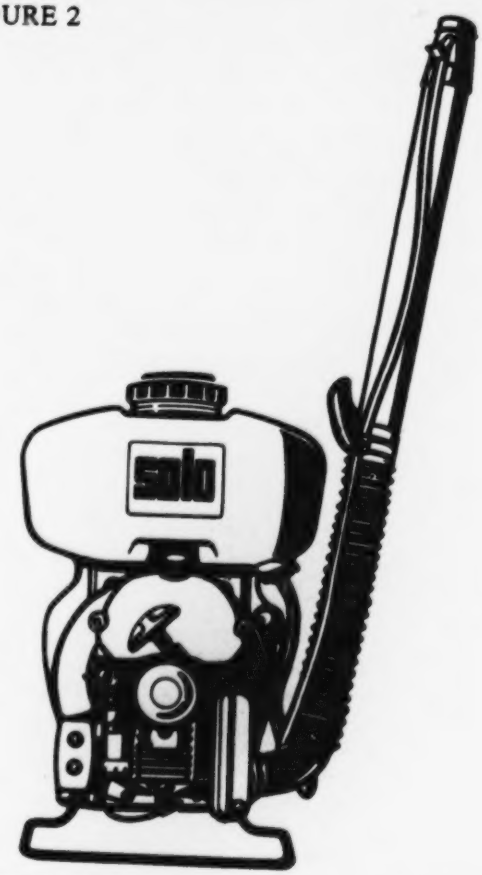


Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

**OBJECTIVE 16**

**Select from a list true statements about the information on a hazardous materials classification card.**

NOTE: The Hazardous Materials Classification Card is part of the Hazardous Communication, or the "Right To Know" Law, stating the dangers that are present in all workplaces. You may see the entire card displayed on a door or window, or only the diamond may be displayed. By memorizing only 25 items, the numerical symbols and the position/color code, you will be able to identify the hazardous conditions where you work or do business.

- **Colors and positions**

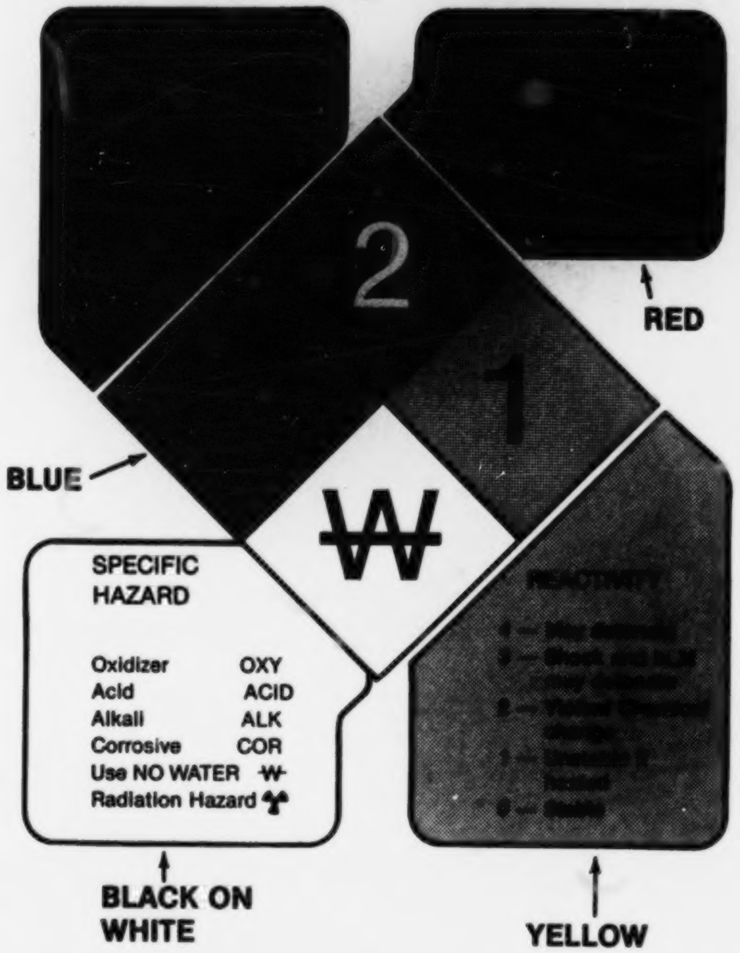
  Blue, left-hand diamond—Health hazards

  Red, top diamond—Fire hazard

  Yellow, right-hand diamond—Reactivity

  Black on white, bottom diamond—Specific hazards

## Hazardous Materials Classification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W
SPECIFIC HAZARD
Oxidizer OXY
Acid ACID
Alkali ALK
Corrosive COR
Use NO WATER W
Radiation Hazard
RED
BLUE
BLACK ON WHITE
YELLOW

BEST COPY AVAILABLE

## Poison Control Centers
## Oklahoma

| | | | |
|---|---|---|---|
| State Coordinator<br>405/271-5454<br>or<br>800-522-4611 | Oklahoma Poison Control Center<br>Oklahoma Children's Memorial Hospital<br>P.O.Box 26307<br>Oklahoma City, OK 73126 | 800 522-4611<br>(Oklahoma) | Oklahoma Children's Memorial Hospital<br>P.O. Box 26307<br>73126 |
| ADA<br>405/322-2323<br>Ext.200 | Valley View Hospital<br>1300 E. 6th St.<br>74820 | PONCA CITY<br>405/765-3321 | St. Joseph Medical Ctr.<br>14th & Hartford 74601 |
| ARDMORE<br>405/223-5400 | Memorial Hospital of Southern Oklahoma<br>11011-14th Ave. 73401 | LAWTON<br>405/355-8620 | Comanche County Memorial Hospital<br>3401 Gore Blvd. 73501 |
| OKLAHOMA CITY<br>405/271-5454 | Oklahoma Poison Control Center | McALESTER<br>918/584-1351 | McAlester General Hosp., Inc. West<br>P.O. Box 669 74501 |
| | | TULSA<br>918/584-1351 | Hillcrest Medical Ctr.<br>1653 East 12th |

## NEARBY OUTSTATE POISON CONTROL CENTERS

**ARKANSAS**
St. Edward's Mercy Hospital
1411 Rogers Avenue
Ft. Smith, Arkansas 72901
AC/501-782-3071 Ext. 210

Sparks Regional Medical Center
1311 Eye Street
Ft. Smith, Arkansas 72901
AC/501-441-5381

**MISSOURI**
Poison Control Center
St. John's Hospital
2727 McClelland Boulevard
Joplin, Missouri 64801
AC/417-781-2727 Ext. 276

**KANSAS**
Labette County Medical Center
South 21st Street
Parson, Kansas 67357
AC/316-421-4880

Wesley Medical Center
550 N. Hillside Avenue
Wichita, Kansas 67214
AC/316-685-2151 Ext. 7515

**TEXAS**
Amarillo Poison Control Center
Amarillo Hospital District
Amarillo Emergency Receiving Center
P.O. Box 1110
2203 West 6th Street
Amarillo, Texas 79175
AC/806-376-4431 Ext. 501, 502, 503, 504

Wichita Falls Poison Control Center
Wichita General Hospital
Emergency Room
1600 Eighty Street
Wichita Falls, Texas 76301
AC/817-322-6771

Courtesy of Oklahoma State University Cooperative Extension Service

705

## THE TOXICITY OF CHEMICAL CONTROLS

**LD—Lethal dose**

**LC—Lethal concentration**

- **mg**—Milligram, a small amount of weight, equal to 1/1000 of a gram; a gram is equal about 1/28 of an ounce
- **kg**—Kilogram, weight measure equal to 2.2 pounds
- **$LD_{50}$**—Measure of acute oral and dermal toxicity. $LD_{50}$ represents the average lethal dose per unit of body weight required to kill 50% of the animals exposed to the pesticide. $LD_{50}$ values are measured from zero, so the lower the $LD_{50}$, the more acutely toxic the pesticide.

  EXAMPLE: Temik® has an $LD_{50}$ of 5. This means it takes 5 mg per kg of body weight to kill 50% of the animals exposed to the pesticide. Mg/kg is the same as parts per million. If the oral $LD_{50}$ of the insecticide parathion is 4, it would take 4 parts of parathion for every million parts of body weight to kill at least half the test animals.

As a comparison, the oral $LD_{50}$ value of table salt is 1,200 mg/kg, or 3.6 oz for a 187-lb. man. The $LD_{50}$ for aspirin is 3,320 mg/kg or less than 1 oz per 187-lb man, the same $LD_{50}$ value as malathion.

- **$LC_{50}$**—Measure of acute inhalation toxicity; the average lethal concentration inhaled per unit of air (mg/L, milligrams per liter). The lower the $LC_{50}$ number, the more poisonous the pesticide.

See Acute Toxicity Measures and Warnings on back of this page.

**Table 2. Acute Toxicity Measures and Warnings**

| | | Categories of Acute Toxicity | | | |
|---|---|---|---|---|---|
| | | $LD_{50}$ | $LD_{50}$ | $LC_{50}$ | |
| **Categories** | **Signal Word Required on the Label** | **Oral mg/kg** | **Dermal mg/kg** | **Inhalation mg/l** | **Probable Oral Lethal Dose For 150 lb. person** |
| I Highly Toxic | DANGER POISON—skull and crossbones | 0-50 | 0-200 | 0-2000 | A few drops to a teaspoonful |
| II Moderately Toxic | WARNING | 50. to 500 | 200. to 2000 | 2000. to 20,000 | Over one teaspoonful to one ounce |
| III Slightly Toxic | CAUTION | 500. to 5000 | 2000. to 20,000 | | Over one ounce to one pint or one pound |
| IV Relatively Non-Toxic | CAUTION | 5000. | 20,000. | | Over one pint or one pound |

## DERMAL EXPOSURE

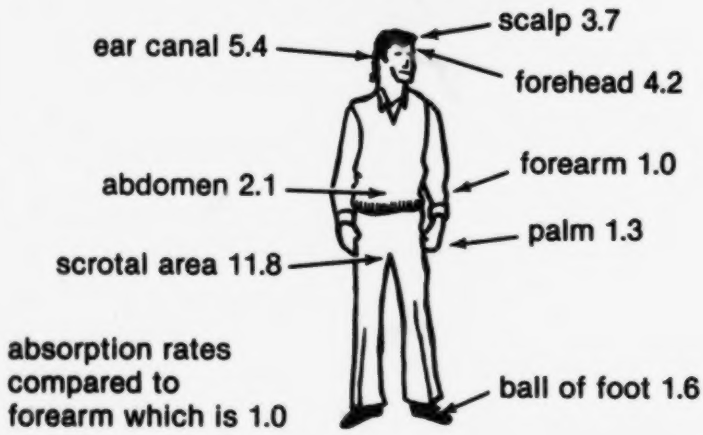
Dermal or skin exposure accounts for about 90% of pesticide applicator poisonings. Any time you mix, apply, or handle pesticides, you can be exposed to dermal toxicity—often without knowing it. Liquids, solutions, and aerosols are obvious dangers, but you can absorb toxins with dry types, too—dusts, wettable powders and granules.

How seriously you can be injured depends on 5 factors:

- The dermal toxicity of the pesticide
- The size of the skin area exposed
- The length of time the chemical is in contact with your skin
- The amount of pesticide on the skin
- The rate of absorption through the skin

Rates of absorption through the skin are different for different parts of the body. Look at the picture below. Compared to the absorption rate of the forearm, which is 1.0, absorption is over 4 times faster on the forehead and more than 11 times faster in the lower groin area. Absorption through the groin is so fast, it is similar to having the poison injected directly into the bloodstream.

DERMAL EXPOSURE


scalp 3.7
ear canal 5.4
forehead 4.2
forearm 1.0
abdomen 2.1
palm 1.3
scrotal area 11.8
absorption rates compared to forearm which is 1.0
ball of foot 1.6

Comparative rates of dermal absorption for different parts of the body.

RESTRICTED USE PESTICIDE

# Supracide 2E

## Insecticide-Miticide

**For control of certain insects of alfalfa; artichokes; certain citrus, fruits and nuts; cotton; nursery stock; olives; safflowers; sunflowers; sorghum; and tobacco**

| | |
|---|---|
| **Active Ingredient:**<br>**Methidathion: O, O-dimethyl phosphorodithioate, S-ester with 4-(mercaptomethyl)-2-methoxy-$\Delta^2$-1,3,4-thiadiazolin-5-one** ............. | **24.4%** |
| **Inert Ingredients:** | **75.6%** |
| **Total:** | **100.0%** |

**2½ Gallons**
**U.S. Standard Measure**

**Supracide 2E contains 2 lbs. active ingredient per gallon.**

**Keep Out of Reach of Children.**

**DANGER/PELIGRO**

**PRECAUCIÓN AL USUARIO: Si usted no lee inglés, no use este producto hasta que la etiqueta haya sido explicado ampliamente.**

**See additional precautionary statements at end of label booklet.**

**See directions for use inside booklet.**

**EPA Est. 100-AL-1**
**EPA Reg. No. 100-501**

**Supracide® trademark of CIBA-GEIGY for methidathion**

**©1989 CIBA-GEIGY Corporation**

**Agricultural Division**
**CIBA-GEIGY Corporation**
**Greensboro, North Carolina 27419**
**CGA 30L23F 059**

CIBA-GEIGY

**DIRECTIONS FOR USE AND CONDITIONS OF SALE AND WARRANTY**

**IMPORTANT:** Read the entire Directions for Use and the Conditions of Sale and Warranty before using this product. If terms are not acceptable, return the unopened product container at once.

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### Conditions of Sale and Warranty

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The Directions for Use of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application all of which are beyond the control of CIBA-GEIGY or the Seller. All such risks shall be assumed by the Buyer.

CIBA-GEIGY warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use subject to the inherent risks referred to above. **CIBA-GEIGY makes no other express or implied warranty of Fitness or Merchantability or any other express or implied warranty. In no case shall CIBA-GEIGY or the Seller be liable for consequential, special, or indirect damages resulting from the use or handling of this product.** CIBA-GEIGY and the Seller offer this product, and the Buyer and user accept it, subject to the foregoing Conditions of Sale and Warranty, which may be varied only by agreement in writing signed by a duly authorized representative of CIBA-GEIGY.

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### DIRECTIONS FOR USE

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It is a violation of federal law to use this product in a manner inconsistent with its labeling.

**FAILURE TO FOLLOW THE DIRECTIONS FOR USE AND PRECAUTIONS ON THIS LABEL MAY RESULT IN POOR INSECT AND MITE CONTROL, CROP INJURY, AND/OR ILLEGAL RESIDUES.**

**General Information**

Supracide 2E is an emulsifiable concentrate which when applied according to the Directions for Use will control certain insect pests and mites on agricultural crops.

Wear protective clothing as described in the USDA/EPA Guide for Commercial Applicators during the preparation of the spray mixture and during application.

Do not apply this product in such a manner as to directly or through drift expose workers or other persons except those knowingly involved in the application. Do not treat while unprotected humans or domestic animals are present in the treatment area.

**Reentry Statement**

Two days must elapse between the time of application and the time a worker reenters the treated area when Supracide 2E is applied at rates up to 2 lbs. ai/A.

Fourteen days must elapse between the time of application and the time a worker reenters the treated area when Supracide 2E is applied at rates greater than 2 lbs. ai/A and up to the maximum label rate of 10 lbs. ai/A. Do not apply Supracide at a rate exceeding 10 lbs. ai/A.

If a worker chooses to reenter a treated field prior to the allowable time of reentry, protective clothing consisting of a protective suit worn over normal work attire, chemical resistant gloves, chemical resistant shoes, shoe covers or boots, a NIOSH or MSHA approved respiratory protection device, goggles or face shield must be worn. Protective clothing must be removed daily and laundry washed, keeping the

CGA 130-584K

# Supracide® 2E

clothing separate from regularly worn clothing. Fresh protective clothing must be worn each day that the worker enters a field prior to the allowable time.

Because certain states may require more restrictive reentry intervals for various crops treated with this product, consult your State Department of Agriculture for further information.

Written or oral warnings must be given to workers who are expected to be in a treated area or in an area about to be treated with this product. Oral warnings must inform workers of areas or fields that may not be entered without specific protective clothing until the intervals stated above have elapsed, and appropriate actions to take in case of accidental exposure, as described under **Precautionary Statements** on this label. When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given if there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information: "DANGER. Area treated with Supracide 2E on (date of application). Do not enter without appropriate protective clothing until (date based on intervals stated above). In case of accidental exposure, flush eyes or skin with plenty of water. Call physician if irritation persists. Remove and wash contaminated clothing before reuse."

### Mixing Procedures

(1) Be sure sprayer is clean; if it is contaminated with any material, crop injury or sprayer clogging may result. (2) Fill tank ¼ - ½ full with clean water, and start agitation. (3) Be certain that the agitation system is working properly and creates a rippling or rolling action on the liquid surface. (4) Add Supracide to the tank. Then add tank mix ingredients. (5) Complete filling tank, maintaining sufficient agitation at all times to ensure surface action. This applies to both spray and nurse tanks. (6) Do not leave tank mixtures in the tank without adequate agitation. Always maintain agitation to avoid separation and buildup of residues. If a residue starts to build up in tank, drain and clean with strong detergent and ammonia solution and rinse thoroughly with clean water. (7) Immediately after use, clean sprayer thoroughly by flushing system with water containing a detergent and rinse with clean water.

**Chemigation:** Do not apply this product through any type of irrigation system.

### Alfalfa (Pure Stands or Stands Containing Clover or Grass) and Pure Stands of Timothy Grass

Apply at the rates listed below in a minimum of 10 gals. of water per acre with ground equipment or 2 gals. of water per acre by air. For alfalfa weevil and Egyptian alfalfa weevil control, make foliar applications to standing alfalfa when 20-30% of the growing tips show insect feeding damage. Make stubble applications immediately following a cutting. For other insects listed on alfalfa, apply when insects first appear. Make no more than one stubble application and no more than one foliage application per cutting. Use the lower rate for light infestations and the higher rate for moderate to heavy infestations.

**Table 1: Rates Per Acre**

| Insects Controlled | Northeastern States | Southern States | California | Pacific Intermountain States Excluding CA |
|---|---|---|---|---|
| Alfalfa weevil | 2-4 pts. | 3-4 pts. | 2 pts. | 2-4 pts. |
| Aphids | 2-4 pts. | 3-4 pts. | 2 pts.* | 2-4 pts. |
| Egyptian alfalfa weevil | — | — | 2 pts.* | 2-4 pts. |
| Grass scale *(Eriococcus insignis)* | — | — | — | 4 pts. (Washington only) |
| Lygus | — | — | 2 pts. | 2-4 pts. |
| Leafhoppers | 2-4 pts. | 2-4 pts. | 2 pts. | 2-4 pts. |
| Spittlebugs | 2-4 pts. | — | — | — |

*Egyptian alfalfa weevil and pea aphid: (California only) Use 1-2 pts. where integrated control is practiced. Apply as above. When Egyptian alfalfa weevil larval counts exceed 20 per sweep, use the 2 pt. rate only.

**Note:** To avoid injury to pollinating insects, do not apply during bloom. To avoid illegal residues, do not apply within 14 days of cutting, grazing, or feeding to livestock.

### Almonds

*Dilute and Concentrate Sprays*

Peach twig borer, San Jose scale, brown almond mite: Apply during the dormant or delayed dormant period, or as a cover spray. Mix a dilute spray at the rate of 1-2 pts. per 100 gals. of water and apply 300-600 gals. per acre. If applying as a concentrate spray*, apply 3-12 pts. per acre in a minimum of 50 gals. of water per acre. For rates less than 2 pts. of Supracide per 100 gals., tank mix with EPA-registered oil.

When concentrate applications are made, proper equipment must be used to obtain uniform coverage.

*Aerial Sprays*

Peach twig borer, San Jose scale: Apply during the dormant or delayed dormant period and use 6-12 pts. per acre as an aerial spray* in a minimum of 20 gals. of spray per acre. Spray swath should be no wider than the distance between the tree rows or the length of the spray boom.

EPA-registered oils may be added to the Supracide spray mixture in the dormant/delayed dormant period. Do not use more than 1.5 gals. of oil per 100 gals. spray as a dilute spray or 6 gals. of oil per acre as a concentrate spray or 5 gals. of oil per acre as an aerial spray.

*The rate of Supracide for concentrate and aerial sprays is based on a dilute spray with conventional ground equipment. A dilute spray is considered to be 300-600 gals. per acre. This amounts to a minimum of 6 pts. and a maximum of 12 pts. of Supracide per acre.

**Note:** To avoid illegal residues, (1) Do not make more than one application during the dormant or delayed dormant period nor more than one cover spray each season. (2) Do not apply within 90 days of harvest. (3) Do not graze treated areas or feed cover crops grown in treated areas to livestock.

*Precaution: Apply the dormant/delayed dormant application before any blossoms open, or injury may occur. Do not combine with oils in the cover spray, or injury or excessive residues may occur. The cover spray of Supracide may be slightly phytotoxic on some almond varieties.*

### Artichokes

Apply in a minimum of 50 gals. of water with ground equipment or a minimum of 10 gals. of water by air. Begin applications when insects appear in newly planted fields or when shoots emerge following complete cutback of the plants. Continue applications at 14 day intervals until buds begin to appear. Do not plant crops except those listed on this label within one year after last application.

Artichoke plume moth, chrysanthemum leafminer: Apply 4 pts. per acre.

**Note:** To avoid illegal residues, (1) Do not apply after buds begin to form. (2) Avoid application under conditions which favor drift to adjacent artichoke fields where buds are present. (3) Do not exceed a total of 8 applications per crop cycle.

### Cotton

Apply in a minimum of 10 gals. of water with ground equipment or in a minimum of 3 gals. of water by air unless otherwise specified.

Spider mites, boll weevil, bollworm: Apply 4 pts. per acre. Repeat applications at 5-7 day intervals if necessary.

Lygus bug: (Arizona, California only) Apply 2-4 pts. per acre. Use the low rate for light to moderate infestations and the high rate for moderate to heavy infestations. Repeat applications if necessary.

Pink bollworm: (Arizona, California only) Apply 2 pts. per acre. Repeat applications at 5-7 day intervals if necessary.

Bandedwing whitefly: (mid-South and southeast United States only) Apply 1-2 pts. per acre. Use the low rate for light to moderate infestations and the high rate for moderate to heavy infestations. Repeat applications if necessary.

**Note:** To avoid illegal residues, (1) Do not apply more than 16 pts. per acre during any one growing season. (2) Do not apply within 14 days of harvest. (3) Do not apply more than the 2 pt. per acre rate to open bolls. (4) Do not graze treated cotton plants or feed gin trash to livestock.

### Deciduous Fruit

*Dilute and Concentrate Sprays*

See Table 2 for specific crops and insects. Apply during the dormant or delayed dormant period. Use a rate of 1-2 pts. per 100 gals. of water as a dilute spray (300-600 gals. per acre) or a rate of 3-12 pts. per acre as a concentrate spray* (a minimum of 50 gals. of water per acre). The lower rates may be used for light infestations and the higher rates for moderate to heavy infestations. For rates less than 2 pts. of Supracide per 100 gals., tank mix with an EPA-registered oil.

When concentrate applications are made, proper equipment must be used to obtain uniform coverage.

**Table 2: Deciduous Fruits**

| Crop | Insects |
|---|---|
| Apples | San Jose scale,<br>rosy apple aphid |
| Cherries, pears | San Jose scale |
| Nectarines, peaches, plums, prunes | Peach twig borer,<br>San Jose scale,<br>Green peach aphid[1] |
| Apricots | Peach twig borer |
| Pears† | Pear psylla[2] |

† California only

[1] For green peach aphid, use 8 pts. Supracide + 4 gals. oil per acre or 12 pts. Supracide per acre alone.

[2] For pear psylla, use 8-12 pts. Supracide + 4-6 gals. oil in a minimum of 100 gals. total spray per acre.

*Aerial Sprays*

See Table 3 for specific crops and insects. Apply during the dormant or delayed dormant period and use 3-12 pts. per acre as an aerial spray* in a minimum of 20 gals. total spray per acre. Spray swath should be no wider than the distance between the tree rows or the length of the spray boom. The lower rates may be used for light infestations and the higher rates for moderate to heavy infestations. For rates less than 2 pts. of Supracide per 100 gals., tank mix with an EPA-registered oil.

**Table 3: Deciduous Fruits (Continued)**

| Crop | Insects |
|---|---|
| Apples | San Jose scale,<br>rosy apple aphid |
| Peaches, plums, prunes, nectarines, apricots | Peach twig borer,<br>San Jose scale |
| Cherries, pears | San Jose scale |

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# Supracide® 2E

EPA-registered oils may be added to the Supracide spray mixture in the dormant/delayed dormant period. Do not use more than 1.5 gals. of oil per 100 gals. spray as a dilute spray or 6 gals. of oil per acre as a concentrate spray or 5 gals. of oil per acre as an aerial spray.

*The rate of Supracide for concentrate and aerial sprays is based on a dilute spray with conventional ground equipment. A dilute spray is considered to be 300-600 gals. per acre. This amounts to a minimum of 3 pts. and a maximum of 12 pts. of Supracide per acre.

**Note:** To avoid illegal residues, (1) Apply before any blossoms open or injury may occur. (2) Do not graze treated areas or feed cover crops grown in treated areas to livestock.

*Precaution: Do not use Supracide on Red Beaut plums.*

**Grapefruits, Lemons, Oranges and Other Citrus Fruits**

*Supracide Alone*

Apply the recommended rates any time except during the bloom period or within 14 days of harvest. Preferred timing is during the immediate post bloom period, before fruit becomes infested. Use the low rate for light infestations and the high rate for moderate to heavy infestations. Thorough coverage is essential for good control.

Make no more than 2 applications per growing season and allow at least 45 days between applications. Severe infestations may require 2 treatments.

California red scale: (Arizona and California only) Apply 1-2 pts. per 100 gals. of water.

Black scale: (California only) Apply 1-2 pts. per 100 gals. of water.

Chaff, Glovers, purple, snow, yellow scale, and mealybug: (Florida only) Apply ½-2 pts. per 100 gals. of water.

Black scale, whiteflies, and citrus blackfly: (Florida only) Apply 1-2 pts. per 100 gals. of water.

Brown soft, California red, chaff scale, and mealybug: (Texas only) Apply ½-2 pts. per 100 gals. of water.

The minimum amount of Supracide applied per acre is dependent upon the number of trees per acre and upon tree height. See example below.

**Example:** Mature trees of normal foliage require a minimum of 5 gals. of spray plus one additional gallon for each foot of tree height for adequate coverage. Eighty trees per acre 20 feet tall require 80 x 25 = 2,000 gals. of dilute spray per acre.

**Note:** To avoid illegal residues, (1) Do not apply more than 40 pts. per acre. (2) Do not graze treated areas. (3) Make no more than 2 applications per growing season nor apply within 14 days of harvest.

*Supracide Plus Oil*

In Florida and Texas, EPA-registered citrus spray oils at rates of 2-4 qts. per 100 gals. of water may be tank mixed with Supracide following the rates and timing listed above for Supracide alone.

In California, EPA-registered citrus spray oils at rates listed below may be tank mixed with Supracide. See the above directions for rates and timing. A rate of ½ pt. of Supracide per 100 gals. of water may be used if tank mixed with oil.

| Type of oil | Amount per 100 gals. of water |
|---|---|
| Light—medium grade | 1.6 - 1.8 gals. |
| Medium grade | 1.6 - 1.8 gals. |
| Narrow—range 415 grade | 1.2 - 1.4 gals. |

For further details, consult the current *University of California Citrus Treatment Guide.*

**Note:** To avoid illegal residues, (1) Do not apply more than 40 pts. of Supracide per acre in any one season. (2) Do not graze treated areas. (3) Make no more than 2 applications with oil per growing season nor apply within 60 days of harvest. (4) Lemons only, do not exceed 10 pts. per acre or apply more than once per season when tank mixed with oil.

**Mangoes**

Apply during the postharvest to bloom stage with ground equipment in 100 gals. of spray mixture per acre. Spray foliage to thoroughly wet upper and lower leaf surfaces. Repeat as needed at 3 week intervals.

False oleander scale, *Pseudaulacaspis cockerelli* (cooley): Apply ½-1 pt. and 0.5% oil per acre.

**Note:** To avoid illegal residues, (1) Do not exceed 5 applications per season. (2) Do not graze or feed cover crops from treated groves.

**Nursery Stock (woody ornamental or herbaceous plants commercially grown for transplanting)**

Apply at the rate listed below in a thorough cover spray to runoff. Thorough coverage and timing of application are essential for effective control.

To control scale insects on nursery stock, including both potted and field grown plants, apply two pints per 100 gals. of water once per season after scale crawlers have hatched. Monitor populations closely to determine when crawlers are present.

Because of changing cultivars in the nursery industry, test each new cultivar for phytotoxicity by treating one plant with the recommended rate at least 2 days prior to treatment of the remaining plants.

**Olives**

Apply once during the postharvest or prebloom season at the rate listed below as a full cover spray in a minimum of 400 gals. of water per acre. Supreme or superior type oil may be added to the spray mixture at the rate of 1-1.5 gals. per 100 gals. of water.

Black scale: Apply 2 pts./100 gals.

**Note:** To avoid illegal residues, (1) Do not apply more than 12 pts. per acre per year. (2) Do not apply after buds break. (3) Do not graze treated areas or feed cover crops grown in treated areas to livestock.

**Pecans (Southeastern U.S. Only)**

Apply the appropriate rate listed below as a foliar or full cover spray in sufficient water for thorough coverage.

Yellow pecan aphid: Apply 2 pts. per 100 gals. and repeat as necessary at 14-21 day intervals.

Hickory shuckworm and pecan serpentine leafminer: Apply 2-4 pts. per 100 gals. when insects first appear or leafminer damage first appears and repeat as necessary at 14-21 day intervals. Use the 4 pt. per 100 gals. rate when infestations are heavy.

*Precaution: Do not tank mix Supracide with Cyprex® as phytotoxicity may result.*

**Note:** To avoid illegal residues, (1) Do not apply within 60 days of harvest. (2) Do not graze treated areas.

**Safflowers**

Apply in a minimum of 20 gals. of water by ground equipment or in a minimum of 5 gals. of water by air.

Lygus bugs and thrips: Apply 2 pts. per acre. Begin applications either at bud stage, 12-14 days before onset of bloom, or as infestations develop. Additional applications can be made on a 7-14 day schedule or as further infestations develop.

**Note:** To avoid illegal residues, (1) Do not apply within 28 days of harvest. (2) Do not make more than three applications per year. (3) Do not graze treated areas.

**Sunflowers**

Apply 2 pts. per acre. Make ground application in a minimum of 10 gals. of water per acre; aerial application in a minimum of 5 gals. of water per acre. Thorough coverage of the heads is necessary. One to three applications may be made on a 7-day schedule. The number of applications will be determined by the severity of the infestations.

Stem weevil*: Begin applications in early season at vegetative stage 2.3 (third alternate leaf developed) to vegetative stage 3.1 (inflorescence head visible but tightly surrounded by young leaves).

Sunflower moth, seed weevil**, banded sunflower moth, and sunflower maggot complex: Begin applications at the onset of bloom as the infestations develop.

Sunflower seed midge: Begin applications during early bud development.

*Cylindrocopturus adspersus and Apion occidentalis.

**Smicronyx fulvus and Smicronyx sordidus.

**Note:** To avoid illegal residues, (1) Do not apply within 50 days of harvest. (2) Do not graze treated areas or feed treated forage to livestock.

**Grain Sorghum Grown for Forage and Grain (Colorado, Kansas, Oklahoma, and Texas Only)**

Apply in a minimum of 10 gals. of water per acre with ground equipment or 2 gals. of water per acre by air. Up to three applications may be made on a 10-14 day schedule. The number of applications will be determined by the severity of the infestation.

Banks grass mite, sorghum greenbug: Apply 2 pts. per acre.

*Precaution: Application may result in phytotoxicity to certain sorghum varieties. This phytotoxicity is a temporary spotting, reddening, or chlorosis of the leaves.*

**Note:** To avoid illegal residues, do not apply within 30 days of harvesting or feeding to livestock.

**Tobacco**

Apply at the rates listed below in a minimum of 25 gals. of water per acre when insects appear. Apply 1-3 repeat applications on a 7-14 day interval as needed.

Flea beetles, hornworms: Apply 2-3 pts. per acre.

Budworms: Apply 4 pts. per acre.

*Precaution: When applying Supracide with hand sprayers, avoid concentrating the spray in the bud area since phytotoxicity may occur. Do not apply Supracide to tobacco plants which are under stress as injury may occur.*

**Note:** Do not apply in mixture with other pesticides or within 3 days of tobacco harvest.

**Walnuts**

*Dilute and Concentrate Sprays*

Walnut scale, frosted scale, Italian pear scale: Apply during the dormant or delayed dormant period or as a cover spray when crawlers appear.

Codling moth, walnut aphid: Apply as a cover spray according to moth activity or when aphids appear.

Use a rate of 2 pts. per 100 gals. of water as a dilute spray (400 gals. per acre), or a rate of 8 pts. per acre as a concentrate spray* (a minimum of 100 gals. of water per acre).

When concentrate applications are made, proper equipment must be used to obtain uniform coverage. If scale infestations are severe, dilute applications should be used.

*Aerial Sprays*

Walnut scale, frosted scale: Apply during the dormant or delayed dormant period and use 8 pts. per acre as an aerial spray* in a minimum of 20 gals. of spray per acre. Spray swath should be no wider than the distance between the tree rows or the length of the spray boom.

EPA-registered oils may be added to the Supracide spray mixture in the dormant/delayed dormant period. Do not use more than 1 gal. of oil per acre in concentrate and aerial sprays or 4 gals. of oil per acre in dilute sprays.

*The rate of Supracide for concentrate and aerial sprays is based on a dilute spray with conventional ground equipment. A dilute spray is considered to be 400 gals. per acre. This amounts to 8 pts. of Supracide per acre.

**Note:** To avoid illegal residues, (1) Make no more than one application during the dormant or delayed dormant period nor more than two cover sprays each season. (2) Do not apply within 7 days of harvest. (3) Do not graze treated areas or feed cover crops grown in treated areas to livestock.

*Precaution: Do not add oil to Supracide sprays to walnuts in southern or central California or to trees that may be subject to stress due to drought, drying winds, disease, or severe insect infestations.*

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# Supracide® 2E

## Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal.

**Storage:** Storage at temperatures above 40°F. Crystals may form at lower storage temperatures. If this occurs, place the product in a warm room (68°F or above) and roll or shake the container at frequent intervals until all crystals are dissolved.

Pouring the product through a 50-mesh or finer screen will indicate adequacy of or need to repeat above procedure. Do not store near food, feed, or fertilizer. Do not use or store in or around the home.

**Pesticide and Container Disposal:** Pesticide wastes are acutely hazardous. Improper disposal of unused pesticide, spray mixture, or rinse water is a violation of federal law. If these wastes cannot be used according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance in proper disposal methods.

Triple rinse container (or equivalent) and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, by incineration, or if allowed by state and local authorities, by burning. Stay out of smoke from burning containers.

For minor spills, leaks, etc., follow all precautions indicated on this label and clean up immediately. Take special care to avoid contamination of equipment and facilities during cleanup procedures and disposal of wastes. In the event of a major spill, fire and other emergency, call 1-800-888-8372 day or night.

## Precautionary Statements

### Hazards to Humans and Domestic Animals

**DANGER**

Corrosive. Causes irreversible eye damage. May cause skin irritation. Do not get in eyes, on skin, or on clothing. Wear goggles or face shield and rubber gloves when mixing. May be harmful or fatal if swallowed or absorbed through skin. Do not breathe vapor or spray mist. Prolonged or repeated inhalation may be harmful. Wear a mask or pesticide respirator jointly approved by the Mining Enforcement Safety Administration (MESA) or the National Institute for Occupational Safety and Health (NIOSH) during periods of prolonged or repeated use. Wash thoroughly with soap and water after handling and before eating, drinking, or smoking. Remove contaminated clothing and wash before reuse or if not washable, discard. Keep out of reach of children and domestic animals.

### Statement of Practical Treatment

**If in eyes:** Flush with plenty of water. Get medical attention immediately.

**If swallowed:** Call a physician or poison control center immediately. DO NOT INDUCE VOMITING UNLESS NO OTHER TREATMENT IS AVAILABLE. Vomiting may cause aspiration pneumonia. If it is necessary to induce vomiting, do so under medical supervision. Give victim one or two glasses of water and insert finger in back of throat. Repeat until vomit fluid is clear. Do not induce vomiting or give anything by mouth to an unconscious person.

**If on skin:** Remove contaminated clothing and wash skin with plenty of soap and water. Get medical attention.

**If inhaled:** Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth unless exposure was due to swallowing; then use cardiopulmonary resuscitation (CPR). Get medical attention.

**Note to Physician:** Lavage stomach with care to prevent aspiration into lungs. After lavage, instill and leave 30 gm. activated charcoal in 3-4 oz. water. Atropine sulfate and 2-PAM are specific antidotes. Morphine, theophylline, aminophylline, and large amounts of intravenous fluids are contraindicated.

### Environmental Hazards

This pesticide is toxic to fish and wildlife. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes). Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water by cleaning of equipment or disposal of wastes.

This pesticide is highly toxic to bees exposed to direct treatment or to residues remaining on the treated crop. Do not apply when bees are actively visiting the crop, cover crop, or weeds blooming in the treated areas. Applications should be timed to provide the maximum possible interval between treatment and the next period of bee activity.

### Physical and Chemical Hazards

Do not use, pour, spill, or store near heat or open flame.

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for methidathion

Cyprex® trademark of American Cyanamid
for dodine

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CIBA-GEIGY Corporation
Greensboro, North Carolina 27419
CGA 30L23F 059

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CIBA–GEIGY

**Tilt®**

One Gallon
U. S. Standard Measure

**FUNGICIDE**

For control of certain diseases in cereals, grasses grown for seed and sugarcane

| | |
|---|---|
| Active Ingredient: 1-[[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl] methyl]-1*H*-1,2,4-triazole | 41.8% |
| Inert Ingredients | 58.2% |
| Total | 100.0% |

EPA Reg. No. 100-617 EPA Est. 100-AL-1

**KEEP OUT OF REACH OF CHILDREN.**

**WARNING**

See additional precautionary statements and directions for use inside booklet

CGA 72L1K 069

## DIRECTIONS FOR USE AND CONDITIONS FOR SALE AND WARRANTY

**Important:** Read the entire **Directions for Use** and the **Conditions for Sale and Warranty** before using this product. If terms are not acceptable, return unopened product container at once.

### Conditions for Sale and Warranty

The **Directions for Use** of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application all of which are beyond the control of CIBA–GEIGY or the Seller. All such risks shall be assumed by the Buyer.

CIBA–GEIGY warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the **Directions for Use** subject to the inherent risks referred to above. **CIBA–GEIGY makes no other express or implied warranty of Fitness or Merchantability or any other express or implied warranty. In no case shall CIBA–GEIGY or the Seller be liable for consequential, special, or indirect damages resulting from the use or handling of this product.** CIBA–GEIGY and the Seller offer this product, and the Buyer and user accept it, subject to the foregoing Conditions of Sale and Warranty, which may be varied only by a duly authorized representative of CIBA–GEIGY.

## DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling.

### General Information

Tilt is a broad spectrum fungicide for the control of certain diseases in wheat, barley, rye, rice, sugarcane, and in grasses grown for seed.

*Note:* Do not use in nurseries, on turf, or landscape plantings.

**FAILURE TO FOLLOW THE DIRECTIONS AND PRECAUTIONS ON THIS LABEL MAY RESULT IN CROP INJURY, POOR DISEASE CONTROL, OR ILLEGAL RESIDUES.**

### Spray Equipment

Thorough coverage is necessary to provide good disease control.

To avoid spray drift, do not apply when conditions favor drift beyond the target area. Avoid spray overlap, as crop injury may occur.

Equip sprayers with nozzles that provide accurate and uniform application. Be certain that nozzles are the same size and uniformly spaced across the boom. Calibrate sprayer before use.

Use a pump with capacity to (1) maintain 35-40 psi at nozzles, and (2) provide sufficient agitation in tank to keep mixture in suspension–this requires recirculation of 10 percent of tank volume per minute. Use a jet agitator or liquid sparge tube for agitation. Do not air sparge.

Although Tilt is an emulsifiable concentrate, it is suggested that screens be used to protect the pump and to prevent nozzles from clogging. Screens placed on suction side of pump should be *16-mesh or coarser*. Do not place a screen in the recirculation line. Use 50-mesh or coarser screens between the pump and boom, and where required, at the nozzles. Check nozzle manufacturer's recommendations.

For more information on spray equipment and calibration, consult sprayer manufacturers and state recommendations. For specific local directions and spray schedules, consult the current state agricultural experiment station recommendations.

To determine the physical compatibility of Tilt with other products, use a jar test. Using a quart jar, add the proportionate amounts of the products to 1 qt. of water. Add wettable powders and water dispersible granular products first, then liquid flowables, and emulsifiable concentrates last. After thoroughly mixing, let stand for at least 5 minutes. If the combination remains mixed or can be remixed readily, it is physically compatible. Once compatibility has been proven, use the same procedure for adding required ingredients to the spray tank.

**Aerial Application:** For those crops where aerial applications are indicated, apply in a minimum of 5 gals. of water/A unless specified otherwise. Avoid application under conditions when uniform coverage cannot be obtained or when excessive spray drift may occur. Do not apply directly to humans or animals. Flagmen and loaders should wash thoroughly before eating, drinking, or smoking, and at the end of each day's operation.

**Ground Application:** Apply Tilt by ground equipment in a minimum of 15 gals. of water/A.

**Chemigation:** Do not apply this product through any type of irrigation system.

### Mixing Procedures

(1) Wear rubber gloves and a long-sleeved shirt when mixing and loading this product. (2) Be sure sprayer is clean; if it is contaminated with any material, crop injury or sprayer clogging may result. (3) Fill tank ¼ - ½ full with clean water, and start agitation. (4) Be certain that the agitation system is working properly and creates a rippling or rolling action on the liquid surface. (5) Add product to the tank. For wheat, barley, rye, and rice, custom applicators must use a closed system for mixing and loading this product. (6) Complete filling tank, maintaining sufficient agitation at all times to ensure surface action. This applies to both spray and nurse tanks. (7) Do not leave tank mixtures in the tank without adequate agitation. Always maintain agitation to avoid separation and buildup of residues. If a residue starts to build up in tank, drain and clean with strong detergent and ammonia solution and rinse thoroughly with clean water. (8) Immediately after use, clean sprayer thoroughly by flushing system with water containing a detergent and rinse with clean water.

### Rotational Crops

To avoid possible illegal residues, (1) Do not double-crop treated acreage when Tilt is applied to the first crop unless the second crop appears on this label. (2) Do not graze or feed forage, fodder, or straw from rotational crops planted in the fall or the spring following treatment.

CGA 130-00724G

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## Cereals

### Wheat, Barley, Rye

In wheat, barley, and rye, Tilt controls rusts (*Puccinia* spp.), powdery mildew (*Erysiphe* spp.), leaf blight and glume blotch (*Septoria* spp.), tan spot (*Pyrenophora tritici-repentis*), Helminthosporium leaf blight, barley scald (*Rhynchosporium secalis*) and net blotch (*Pyrenophora teres*). Apply 4 fl. oz. of Tilt/A by ground or aerial application. Highest yields are normally obtained when Tilt is applied to the emerging flag leaf (Feekes growth stage 8). Do not apply after this growth stage to avoid possible illegal residues. Tilt may be applied earlier if disease symptoms appear (especially applicable to barley). Make only one application per season.

F[illegible] of foot rot (*Pseudocercosporella* sp.), apply 4 fl. oz. of Tilt/A plus half rates of other EPA-registered fungicides such as Benlate®, Mertect®, and Topsin® M. Apply at tillering but before elongation has occurred.

Do not graze or feed livestock treated forage or cut the green crop for hay or silage. After harvest the straw may be used for bedding or feed.

### Rice

In rice, Tilt controls sheath blight (*Rhizoctonia solani*), brown leaf spot (*Helminthosporium oryzae*), narrow brown leaf spot and brown blotch (*Cercospora oryzae*), leaf smut (*Entyloma oryzae*) and sheath spot (*Rhizoctonia oryzae*). Tilt also suppresses stem rot (*Sclerotium oryzae*). Apply Tilt on either of the following schedules as an aerial spray in 5-10 gals. of water/A:

A. 6 fl. oz./A at first internode elongation (up to 2-inch panicle) and repeat at swollen boot. Make a second application 10-14 days after the first application, but before the boot splits and head emerges. Tilt provides best control of sheath blight when the first application is applied at disease appearance in the field. The first application is recommended when 5 percent or fewer of the tillers are infected.

B. 10 fl. oz./A at first internode elongation (up to 2-inch panicle). The 10 oz. rate is recommended if greater than 10 percent of the tillers are infected with the sheath blight. If disease reappears, use another registered fungicide for the second application.

**Notes:** To avoid possible illegal residues,(1) Do not apply to stubble or ratoon crop rice; (2) Do not use in rice fields where commercial farming of crayfish will be practiced; (3) Do not drain water from the treated rice fields into ponds used for commercial catfish farming; (4) Do not use water drained from treated fields to irrigate other crops; and (5) Do not use in California.

**Endangered Species Restrictions:** The use of Tilt (propiconazole) on rice is restricted to protect the endangered fat pocketbook pearly mussel (*Potamilus capax*) and its habitat. Use is prohibited in the following areas of Arkansas:

**Mississippi County**– Within the basin that drains directly into the Right Hand Chute of Little River, south of Big Lake National Wildlife Refuge.

**Poinsett County**– Between Crowley's Ridge and the levee east of the Right Hand Chute of Little River and the St. Francis Floodway. Use is also prohibited west of Rt. 140 and north of Rt. 63 at the siphon near Marked Tree. Except that the prohibited area does not include the area bounded by Arkansas highway 373 on the west, highway 63 on the east and highway 14 on the south.

**Cross, St. Francis, and Lee Counties:** Between Crowley's Ridge and the levee east of the Right Hand Chute of Little River and the St. Francis Floodway as far south as the confluence of L'Anguille River (Lee County).

## Grasses Grown for Seed (Nebraska, Oregon, Washington, Idaho, and Minnesota only)

Tilt controls rusts (*Puccinia* spp.), powdery mildew, and Selenophoma stem eyespot in perennial ryegrass, fescues, bluegrass, orchardgrass, and wheatgrasses.

Mix 4-8 fl. oz. of Tilt (maximum 4 fl. oz. on bluegrass) in a minimum of 20 gals. of water/A for ground application, or in a minimum of 10 gals. of water/A for aerial application. Apply when powdery mildew and Selenophoma infections or rust pustules are noticeable and increasing in number, in late spring or early summer. Repeat at 14-21 day intervals. To maximize control under severe rust pressure, use the higher rate of 8 fl. oz./A (except on bluegrass) and make applications at 14-day intervals until the seed is mature. Do not apply more than 32 fl. oz. of Tilt per acre per growing cycle. Make the last application at least 20 days before seed matures. For bluegrass, it is important to begin applications early in the growing season.

**Notes:** To avoid possible illegal residues, do not: (1) feed hay cut within 20 days of the last application or (2) graze treated areas within 140 days of the last application.

### Sugarcane (Hawaii only)

For control of pineapple disease of sugarcane (*Ceratocystis paradoxa*) apply Tilt to cut seed pieces using 0.75 fl. oz. (22 ml) per 100 gals. of water (1:17,000). Treatments can be applied in either a cold or hot water dip. Do not use treated seed pieces for food or feed purposes. Dispose of spent dip solution according to state and federal regulations.

**Cold Water Dip**–Immerse seed pieces to give thorough wetting, remove and allow to drain.

**Hot Water Dip**– Maintain water temperature at 52°C. Soak the seed pieces for 20-30 minutes, remove and allow to drain.

## Storage and Disposal

Store at temperatures above 0°F. Do not contaminate water, food, or feed by storage or disposal. Pesticide wastes may be toxic. Improper disposal of unused pesticide, spray mixture, or rinse water is a violation of federal law. If these wastes cannot be used according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance in proper disposal methods.

Triple rinse container (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, by incineration, or, if allowed by state and local authorities, by burning. Stay out of smoke from burning containers.

For minor spills, leaks, etc., follow all precautions indicated on this label and cleanup immediately. Take special care to avoid contamination of equipment and facilities during cleanup and disposal of wastes. In the event of a major spill, fire, or other emergency, call 1-800-888-8372 day or night.

## Precautionary Statements

### Hazards to Humans and Domestic Animals

**WARNING**

This product may cause skin sensitization reactions in certain individuals. Wear rubber gloves and a long-sleeved shirt when mixing or handling this product. Remove contaminated clothing and wash before reuse.

Causes eye irritation. Do not get in eyes, on skin, or on clothing. Harmful if swallowed, inhaled or absorbed through skin. Wash thoroughly with soap and water after handling. Avoid breathing spray mist.

**First Aid:** If in eyes, flush with plenty of water and get medical attention if irritation persists. If on skin, wash with plenty of soap and water. Get medical attention if irritation persists. If swallowed, drink promptly a large quantity of milk, egg whites, or gelatin solution; if these are not available, drink large quantities of water. Never give anything by mouth to an unconscious person. Do not induce vomiting. Call a physician or Poison Control Center immediately. In case of inhalation exposure, move to fresh air.

**Note to Physician:** There is no specific antidote for this product. Induce emesis or lavage stomach, taking care to avoid aspiration of stomach contents into lungs. Give a saline laxative and supportive therapy.

### Environmental Hazards

This pesticide is toxic to fish. Do not apply directly to water. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not contaminate water when disposing of equipment wash waters. Refer to product labeling for use restrictions to protect endangered species.

### Physical or Chemical Hazards

Do not use, pour, spill, or store near heat or open flame.

Benlate® trademark of E.I. duPont de Nemours & Co. (Inc.) for benomyl

Mertect® trademark of Merck and Co., for thiabendazole

Tilt® trademark of CIBA–GEIGY
U.S. Patent No. 4,079,062

Topsin® trademark of Pennwalt Corporation for thiophanate-methyl

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CGA 72L1K 069

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## MSDS INFORMATION CHECKLIST

**PRODUCT**

MSDS ____________ DATE_______

Product identity (common or trade name) as used on the label.

The specific chemical and common name(s), if not considered a trade secret, of the hazardous ingredients* which contribute to known hazards.

The physical and chemical characteristics of the hazardous chemical, e.g. flash point, vapor pressure, appearance, etc.

The physical hazards of the chemical including the potential for fire, explosion, and reactivity.

Known acute and/or chronic health effects including signs and symptoms of exposure and health conditions that are aggravated by exposure.

Primary route(s) or entry.

OSHA PEL, ACGIH TLV, and manufacturer's recommended exposure limits.

Whether the chemical is considered to be a carcinogen by NTP, IARC, or OSHA.

Precautionary measures for safe handling and use.

Applicable control measures such as engineering controls, safe work practices, or personal protective equipment.

Emergency and first aid procedures.

Name, address and phone number of the party responsible for the preparation of the MSDS.

715

Date of preparation or last revision.

Blank spaces are not authorized. If information is not applicable or not available, it should be noted as such.

Other________________________________________

___________________________________________

716

*If the hazardous chemical is a mixture which has not been tested as a whole, the chemical and common names of all ingredients which have been determined to be health hazards and which comprise 1% or greater (0.1% for carcinogens) of the composition must be listed.

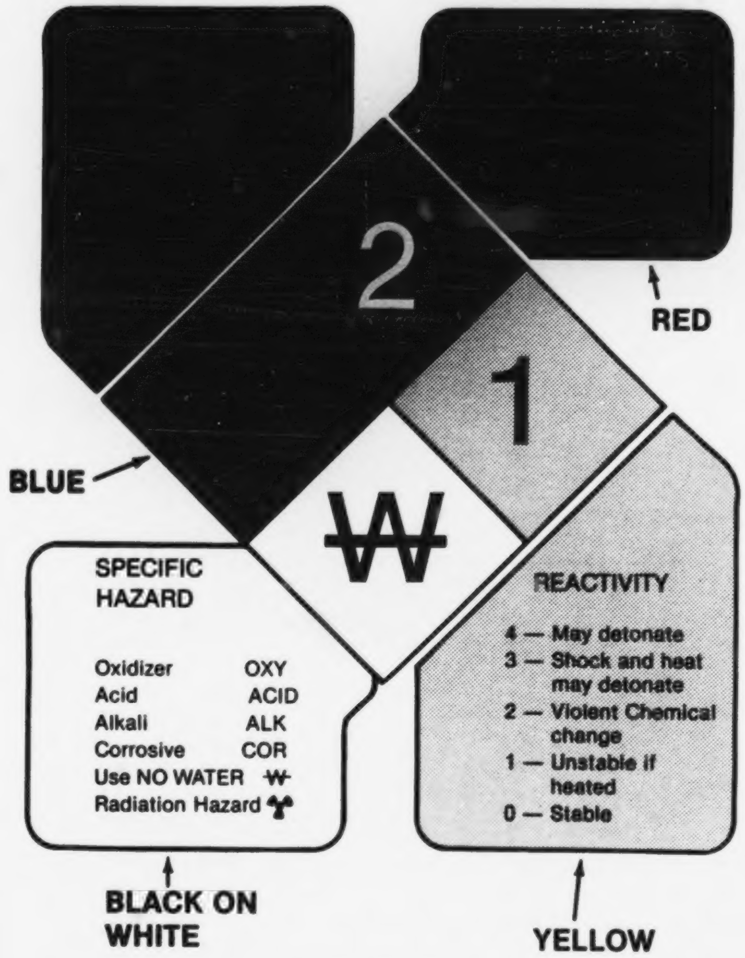
## HAZARDOUS MATERIALS CLASSIFICATION SYSTEM

Blue, left-hand diamond—Health hazards

Red, top diamond—Fire hazard

Yellow, right-hand diamond—Reactivity

Black on white, bottom diamond—Specific hazards


2
1
W
RED
BLUE
SPECIFIC HAZARD
Oxidizer OXY
Acid ACID
Alkali ALK
Corrosive COR
Use NO WATER W
Radiation Hazard
REACTIVITY
4 — May detonate
3 — Shock and heat may detonate
2 — Violent Chemical change
1 — Unstable if heated
0 — Stable
BLACK ON WHITE
YELLOW

BEST COPY AVAILABLE

**ACTIVITY SHEET 1** | **CHEMICAL SAFETY** **X**

NAME ______________________________

## IDENTIFY TYPES OF CHEMICAL CONTROLS USED IN HORTICULTURE

**Your teacher may provide a list of brand names or you may make your own list from a catalog. Look up the brand names and classify them by type as listed below. On selective chemical controls, list at least two pests or types of plants affected.**

**Selective pesticide**

______________

______________

**Nonselective pesticide**

______________

______________

**Insecticide**

______________

______________

**Fungicide**

______________

______________

**Bactericide**

______________

______________

**Nematicide**

______________

______________

**Miticide**

______________

______________

**Acaricide**

______________

______________

**Avicide**

______________

______________

**Rodenticide**

______________

______________

Herbicide

Pyrethrum

Growth regulators: Retardants,

Pinching agent, accelerators

NAME ________________________________

## FIND EXAMPLES OF PESTICIDES

**Use catalogs in your classroom to find an example of each way chemicals work to control pests.**

**Stomach poison—** ____________________

**Contact poison—** ____________________

**Fumigant—** ____________________

**Translocated herbicide—** ____________________

**Systemic—** ____________________

**Protectant—** ____________________

**Sterilant—** ____________________

**Defoliant and desiccant—** ____________________

**ASSIGNMENT SHEET 1**

## CHEMICAL SAFETY

**X**

NAME ______________________________ SCORE ________

**OBJECTIVE 19**

**Complete safety test on reading chemical labels with 100 percent competency.**

**INTRODUCTION**

Safe handling of pesticides and herbicides will help protect you from acute or chronic toxicity. *Take the time and take the trouble to read all the information on all the labels of materials you use.* A single mistake can waste time, energy, money, and materials and—a single mistake can keep you out of class or off the job.

**DIRECTIONS**

Use the labels in Supplements 4 and 5 to answer the following questions.

Circle the correct answers.

1. Who makes Supracide® 2E (the brand name)?
   a. Elanco
   b. Rohm Haas
   c. Monsanto
   d. CIBA-GEIGY
2. Tilt® is which type of pesticide?
   a. Insecticide
   b. Bactericide
   c. Fungicide
   d. Herbicide

3. The "Net Contents" on Tilt® is

   a. 1/2 pint

   b. One quart

   c. One gallon

   d. 2 1/2 gallons

4. The "Net Contents" on Supracide® 2E is________.

   a. One pint

   b. 1/2 quart

   c. One gallon

   d. 2 1/2 gallons

5. Tilt® contains________ active ingredient per gallon.

   a. 3 qts

   b. 76%

   c. 3.6 lb

   d. 50%

6. The active ingredient in Supracide® is________.

   a. Isopropyl

   b. Petroleum

   c. Supracide

   d. Methidathion

7. If you get Tilt® in your eyes, you should________.

   a. Flush with water for at least 5 minutes

   b. Flush with water for at least 15 minutes

   c. Flush with boric acid

   d. Flush with an antiseptic eyewash

8. Reentry time on Supracide® 2E is________.

   a. 30 days on citrus groves

   b. 20 days on all crops

   c. 24 hours

   d. not listed

9. What is the reentry time when you use Supracide® 2E in your school greenhouse?

   a. 15 days

   b. 12 days

   c. 5 days

   d. 2 days

10. The signal word on Tilt® is

   a. DANGER

   b. WARNING

   c. POISON

   d. CAUTION

11. The use classification on Supracide® 2E is________

   a. Limited

   b. General

   c. Restricted

   d. Nonrestricted

12. Storage and disposal instructions on Tilt® state________.

   a. Store at temperatures under 97° C.

   b. Store at temperatures above 2° C.

   c. Store at temperatures under 98° F.

   d. Store at temperatures above 32° F.

13. Storage and disposal instructions on Supracide® 2E state that if unused pesticide or spray mixtures cannot be used according to label instructions, ________.

a. Dispose of by pouring through a 50-mesh or finer screen

b. Dilute by triple rinsing and dispose of excess chemicals

c. Call State Pesticide or Environmental Control Agency

d. Call Poison Control Center

14. The category of applicator on Tilt® is________.

a. General

b. Certified

c. Commercial

d. Not listed

15. The category of applicator on Supracide® is________.

a. General

b. Certified

c. Commercial

d. Not listed

16. The antidote for Supracide® is________.

a. Not listed

b. Atropine

c. Endogine

d. Ester

17. To control yellow pecan aphids in the southwestern states with Supracide® 2E, ________.

    a. apply every 10 days

    b. apply 2 pts per gallon of water

    c. apply 2 pts per 100 gallons of water

    d. apply within 48 hrs after first appearance of aphids

18. The EPA Registrations Number of Supracide® 2E is________.

    a. 100-501

    b. 100-AL-1

    c. 2E

    d. 521330

19. In a fire emergency with Tilt® you can call

    a. State Pesticide or Environmental Control Agency

    b. Agricultural Division, CIBA-GEIGY Corp., Greensboro, NC

    c. (919) 292-7100 day or night

    d. 1-800-522-4611 day or night

20. At present, *you* can legally apply

    a. Supracide® 2E

    b. Tilt®

    c. a and b

    d. Neither

726

**ASSIGNMENT ANSWERS**

# CHEMICAL SAFETY

# X

**ASSIGNMENT SHEET 1**

1. d
2. c
3. c
4. d
5. c
6. d
7. b
8. a
9. d
10. b
11. c
12. d
13. c
14. d
15. b
16. b
17. c
18. a
19. c
20. b

## CHEMICAL SAFETY

**OBJECTIVE 18a**

**Clean chemical containers for disposal.**

**TOOLS AND MATERIALS**

- Chemical containers: paper sack, metal bucket or canister, glass bottle
- Newspapers
- Shovel
- Proper area for disposal, sandy soil away from water source
- Water
- Detergent
- Ax, pick or other puncturing tool
- Protective clothing—unlined neoprene gloves and boots, neoprene apron, face shield, long-sleeved shirt and pants

**PROCEDURE**

**Paper sack**

- Wear unlined neoprene gloves

1. Fold sack with open mouth on the inside
2. Wrap in heavy layers of newspaper
3. Store in locked room until trash pickup

NOTE: Some paper containers can be burned. Check label. Do not inhale smoke.

4. Have your instructor check your work.

**Metal container**

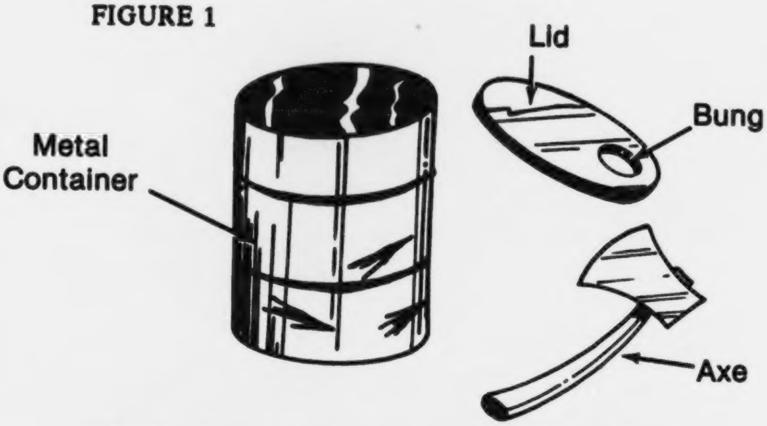
- Wear unlined neoprene gloves and boots, neoprene apron, face shield, long-sleeved shirt with cuffs outside gloves and long pants

1. Dig a pit in sandy soil.
2. Fill container with water and detergent according to chart

| Container Size | Water | Detergent |
|---|---|---|
| 5 gallons | 2 quarts | 2 tablespoons |
| 30 gallons | 3 gallons | 1/2 cup |
| 55 gallons | 5 gallons | 1 cup |

3. Let mixture sit in container for 15 minutes, stirring or agitating periodically.
4. Dump rinse solution in pit.
5. Repeat rinse procedure twice, so that container is triple-rinsed.
6. Remove lid and bung (plug) (Figure 1)
7. Chop holes in the top, bottom and sides.

FIGURE 1



NOTE: Container should be delivered to a public or private dump. The dump manager should be notified as to the type of chemical the container held in order to take necessary precautions.

8. Have your instructor check your work.

**Glass container**

- Wear unlined neoprene gloves and boots, neoprene apron, face shield, long-sleeved shirt with cuffs outside gloves and long pants

1. Follow steps 1 through 5 in Metal Container section.
2. After rinsing and disposing of rinse water, place glass in several layers of newspaper.

3. Break container.

   **NOTE:** Glass pieces should be buried at least 18 inches deep away from water source.

4. Have your instructor check your work.

5. Put away tools and materials and clean the work area.

**JOB SHEET 2**

## CHEMICAL SAFETY

**X**

**OBJECTIVE 18b** **Clean spray equipment after pesticide use.**

**TOOLS AND MATERIALS**

- Sprayer
- Shovel
- Water
- Detergent
- Gasoline or kerosene
- Cup grease or pipe compound
- Protective clothing—unlined neoprene gloves and boots, neoprene apron, face shield, long-sleeved shirt and pants

**PROCEDURE**

**NOTE: Many chemicals are corrosive and will eat away at plastic and metal parts. Some chemicals are held in suspension while the sprayer is in operation, then will settle out and harden if left standing. The sprayer should be thoroughly cleaned after each use.**

1. Dig a pit in sandy soil, away from water lines.
2. Empty any remaining pesticide solution into the pit.
3. Fill sprayer tank with water and detergent according to chart

| Container Size | Water | Detergent |
|---|---|---|
| 5 gallons | 2 quarts | 2 tablespoons |
| 30 gallons | 3 gallons | 1/2 cup |
| 55 gallons | 5 gallons | 1 cup |

4. Let mixture sit in container for 15 minutes, stirring or agitating periodically.
5. While waiting, disassemble nozzles, strainers, and screen.
6. Wash nozzles, strainers and screen with gasoline or kerosene.
7. Dump sprayer tank rinse solution in pit.

8. Flush tank with water at least three times, dumping waste into pit.

9. Allow all parts to dry thoroughly

10. Coat threads with cup grease or pipe compound to prevent the joints from "freezing."

11. Reassemble sprayer.

12. Put away tools and clean the work area.

**JOB SHEET 3**

# CHEMICAL SAFETY

# X

**OBJECTIVE 18c** **Clean spray equipment after herbicide use.**

**TOOLS AND MATERIALS**

- Shovel
- Sprayer
- Detergent
- Water
- Cup grease or pipe compound
- Household ammonia
- Protective clothing—unlined neoprene gloves and boots, neoprene apron, face shield, long-sleeved shirt and pants

**PROCEDURE**

1. Dig a pit in sandy soil.
2. Empty any remaining herbicide into pit.
3. Fill container with water and detergent according to chart

| Container Size | Water | Detergent |
|---|---|---|
| 5 gallons | 2 quarts | 2 tablespoons |
| 30 gallons | 3 gallons | 1/2 cup |
| 55 gallons | 5 gallons | 1 cup |

4. Let mixture sit in container for 15 minutes, stirring or agitating periodically.
5. Dump sprayer tank rinse solution in pit.
6. Flush tank with water at least three times, dumping waste into pit.
7. Disassemble all pieces of sprayer equipment.
8. Soak pieces in a 1% solution of household ammonia:

   To 100 gallons of water, add 1 gallon of ammonia
   25 gallons of water, add 1 quart of ammonia
   5 gallons of water, add 6.4 ounces of ammonia
   1 quart of water, add 2 Tablespoons (1 oz) ammonia

9. Rinse thoroughly.
10. Allow all parts to dry.
11. Coat threads with cup grease or pipe compound to prevent the joints from "freezing."
12. Reassemble sprayer.
13. Put away tools and clean the work area.

**JOB SHEET 1**

**Clean chemical containers for disposal.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| **Paper sack** | | |
| 1. Folded sack with open mouth on the inside | ____ | ____ |
| 2. Wrapped in heavy layers of newspaper | ____ | ____ |
| 3. Stored in locked room until trash pickup | ____ | ____ |
| **Metal container** | | |
| 1. Dug a pit in sandy soil. | ____ | ____ |
| 2. Filled container with water and detergent according to chart | ____ | ____ |
| 3. Let mixture sit in container for 15 minutes, stirred or agitated periodically. | ____ | ____ |
| 4. Dumped rinse solution in pit. | ____ | ____ |
| 5. Repeated rinse procedure twice, so that container was triple-rinsed. | ____ | ____ |
| 6. Removed lid and bung. | ____ | ____ |
| 7. Chopped holes in the top, bottom and sides. | ____ | ____ |

| **The student:** | **YES** | **NO** |
|---|---|---|
| **Glass container** | | |
| 1. Followed steps 1 through 5 in Metal Container section. | ____ | ____ |
| 2. After rinsing and disposing of rinse water, placed container in several layers of newspaper. | ____ | ____ |
| 4. Broke container. | ____ | ____ |
| 5. Used proper tools correctly. | ____ | ____ |
| 6. Performed steps in a timely manner. | ____ | ____ |
| 7. Practiced safety rules throughout procedure. | ____ | ____ |
| 8. Provided satisfactory responses to questions asked. | ____ | ____ |
| 9. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Prepared paper sack | 4 | 3 | 2 | 1 |
| Prepared metal container | 4 | 3 | 2 | 1 |
| Prepared glass container | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 2**

## CHEMICAL SAFETY

**X**

**JOB SHEET 2**

**Clean spray equipment after pesticide use.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Dug a pit in sandy soil, away from water lines. | ____ | ____ |
| 2. Emptied any remaining pesticide solution into the pit. | ____ | ____ |
| 3. Filled sprayer tank with water and detergent according to chart | ____ | ____ |
| 4. Let mixture sit in container for 15 minutes, stirring or agitating periodically. | ____ | ____ |
| 5. Disassembled nozzles, strainers, and screen. | ____ | ____ |
| 6. Washed nozzles, strainers and screen with gasoline or kerosene. | ____ | ____ |
| 7. Dumped sprayer tank rinse solution in pit. | ____ | ____ |
| 8. Flushed tank with water at least three times, dumping waste into pit. | ____ | ____ |
| 9. Allowed all parts to dry thoroughly. | ____ | ____ |
| 10. Coated threads with cup grease or pipe compound to prevent the joints from "freezing." | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 11. Reassembled sprayer. | ____ | ____ |
| 12. Used proper tools correctly. | ____ | ____ |
| 13. Performed steps in a timely manner. | ____ | ____ |
| 14. Practiced safety rules throughout procedure. | ____ | ____ |
| 15. Provided satisfactory responses to questions asked. | ____ | ____ |
| 16. Put away tools and cleaned work area. | ____ | ____ |

### EVALUATOR'S COMMENTS

____________________________________________

____________________________________________

### PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Cleaned pesticide sprayer | | | | |

### EVALUATOR'S COMMENTS

____________________________________________

____________________________________________

____________________________________________

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 3**

## CHEMICAL SAFETY

**X**

**JOB SHEET 3**

**Clean spray equipment after herbicide use.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Dug a pit in sandy soil. | ____ | ____ |
| 2. Emptied any remaining herbicide into pit. | ____ | ____ |
| 3. Filled container with water and detergent according to chart. | ____ | ____ |
| 4. Let mixture sit in container for 15 minutes, stirring or agitating periodically. | ____ | ____ |
| 5. Dumped sprayer tank rinse solution in pit. | ____ | ____ |
| 6. Flushed tank with water at least three times, dumping waste into pit. | ____ | ____ |
| 7. Disassembled all pieces of sprayer equipment. | ____ | ____ |
| 8. Soaked pieces in a 1% solution of household ammonia. | ____ | ____ |
| 9. Rinsed thoroughly. | ____ | ____ |
| 10. Allowed all parts to dry. | ____ | ____ |
| 11. Coated threads with cup grease or pipe compound to prevent the joints from "freezing." | ____ | ____ |
| 12. Reassembled sprayer. | ____ | ____ |
| 13. Put away tools and clean the work area. | ____ | ____ |
| 14. Used proper tools correctly. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 15. Performed steps in a timely manner. | | |
| 16. Practiced safety rules throughout procedure. | | |
| 17. Provided satisfactory responses to questions asked. | | |
| 18. Put away tools and cleaned work area. | | |

### EVALUATOR'S COMMENTS

### PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Cleaned herbicide sprayer | | | | |

### EVALUATOR'S COMMENTS

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

## CHEMICAL SAFETY

## X

NAME ______________________ SCORE ________

**OBJECTIVE 1**

**Match terms associated with chemical safety to their definitions.** Write the correct letters in the blanks.

___ 1. Returning to a chemically treated area after treatment

___ 2. Solid or liquid particles mixed throughout a liquid, but not dissolved in it

___ 3. Ability of a poison to produce adverse effects

___ 4. Food materials, pesticide or herbicide moved from one part of the plant to another

___ 5. Movement of a chemical to an unintended area

___ 6. Person who applies herbicides and pesticides

___ 7. Tiny particles of oil suspended in another liquid

___ 8. Affecting all plants or all parts of plants

___ 9. Inside a plant and moving throughout it

___ 10. Loss of consciousness (passing out) caused by too little oxygen and too much carbon dioxide or other chemical in the blood

___ 11. Poisonous

___ 12. Affecting specific plants or specific parts of plants

___ 13. Letters of a name or title that represent the name or title

___ 14. Strength or effectiveness of a chemical

a. Toxicity
b. Initials
c. Selective
d. Potency
e. Emulsion
f. Acronym
g. Reentry
h. Stock
i. LD level
j. Nonselective
k. Translocated
l. Inflammable
m. Systemic
n. Caustic
o. Concentration
p. Asphyxiation
q. Toxic
r. Applicator
s. Safety time zone
t. Drift
u. Suspension

**OBJECTIVE 2**

**Select from a list true statements concerning pesticide classifications.** Complete the chart as required.

| Class | Level of Toxicity | Used as directed, harmful to humans, animals or environment? | Identification symbol | Restricted Use? |
|---|---|---|---|---|
| I | | | | |
| II | | | | |
| III | | | | |
| IV | | | | |

**OBJECTIVE 3**

**Match common types of chemical controls used in horticulture to their correct descriptions.** Write the correct letters in the blanks.

____1. Insecticide made from dried, powdered chrysanthemum flowers

____2. Kills all pests

____3. Specific or nonspecific controls to retard growth, pinch buds, suppress fruiting and flowering or accelerate growth and flowering

____4. Kills or repels birds that harm or destroy crops

____5. Destroys nematodes

____6. Kills small rodents that feed on crops or seeds

____7. Used against fungi

____8. Used against bacteria

____9. Used against insects

a. Brachicide
b. Raticide
c. Growth Regulators
d. Insecticide
e. Holocide
f. Fungicide
g. Herbicide
h. Avicide
i. Aphidicide
j. Nematicide
k. Miticide
l. Chemkill
m. Acaricide

___ 10. Selective or nonselective material for killing weeds or preventing weed seed germination

___ 11. Destroys mites

___ 12. Kills some pests while not affecting others

___ 13. Destroys or repels spiders, mites and ticks

n. Selective pesticide

o. Bactericide

p. Pyrethrum

q. Rodenticide

r. Nonselective pesticide

**OBJECTIVE 4**

**Match the ways chemical controls work to their correct descriptions.** Write the correct letters in the blanks.

___ 1. Prevents pest entry or damage; can also be a repellent

___ 2. Kills when inhaled or absorbed

___ 3. Kills plants when absorbed by any part of the plant

___ 4. Keeps pests from reproducing or soils from supporting plant life

___ 5. Kills pest when introduced into system of the host, without damaging the host

___ 6. Kills when swallowed

___ 7. Kills the whole organism when any part of the chemical touches it

___ 8. Causes plants to lose foliage

a. Reproductive poison

b. Stomach poison

c. Contact poison

d. Inhalant

e. Fumigant

f. Translocated herbicide

g. Translocated pesticide

h. Systemic

i. Protectant

j. Intestinal poison

k. Sterilant

l. Defoliant and desiccant

m. Foliar poison

**OBJECTIVE 5**

**Match types of chemical control applications to their correct descriptions.** Write the correct letters in the blanks.

**Liquid**

____1. Oil based, mixed with water

____2. Turns to gas when applied, may be packaged in pressurized cans

____3. Highly-concentrated thick liquid mixed with water to form a suspension

____4. Ready to apply; does not require mixing with water

____5. Mixed with water and applied by hand-pumped spray bottle, compressed air sprayer, fogger or pressurized can; low chemical-water ratio compared to other forms

**Dry**

____6. Granules, tablets or some other edible substance containing pesticide

____7. Applied dry; particles are much larger than dust

____8. Dust-like powder is mixed with water and applied wet; must be constantly stirred or agitated to remain in suspension

____9. Powder that dissolves easily in water

___10. Applied dry; active ingredient is a fine powder

a. Solution
b. Bait
c. Flowable
d. Drops
e. Wettable powder
f. Granules
g. Liquid concentrate
h. Fumigant
i. Dust
j. Emulsifiable concentrate
k. Soluble grains
l. Oil
m. Soluble powder
n. Crystals
o. Spray cans

**OBJECTIVE 6** **Distinguish between acute and chronic toxicity.** Write "A" in the blanks before statements about acute toxicity and "C" in the blanks before statements about chronic toxicity.

___ 1. People who load chemical products, work in the same building with toxic materials, mix chemicals or work in chemically treated fields can develop this type of toxicity.

___ 2. Refers to how poisonous a chemical is after one exposure.

___ 3. Occurs over a period of time.

___ 4. Symptoms may appear within a week or toxic buildup can take many years before symptoms appear.

___ 5. Can occur after a single small or large exposure.

___ 6. Refers to how poisonous a chemical is after repeated small doses.

___ 7. Symptoms develop quickly, within a few minutes or within a few hours.

**OBJECTIVE 7** **Define oral, dermal and inhalation toxicity.**

1. Oral toxicity—______________________________

______________________________

2. Dermal toxicity—______________________________

______________________________

3. Inhalation toxicity—______________________________

______________________________

**OBJECTIVE 8** **List symptoms of pesticide poisoning.** List three symptoms for each level of pesticide poisoning.

1. Mild poisoning— ______________________________

______________________________

______________________________

2. Moderate poisoning— ______________________________

______________________________

______________________________

3. Severe poisoning— ______________________

______________________

______________________

**OBJECTIVE 9** **State ten chemical safety precautions.**

**OBJECTIVE 10**

**Complete statements about personal safety precautions for handling chemicals.** Write the correct words in the blanks.

1. Wear________________ ________________ as needed.
2. Never________________, ________________or ________________ while handling chemicals.
3. Wash all exposed body surfaces with ________________ and ________________ immediately after handling chemicals.
4. If chemicals are spilled onto clothing, ________________ ________________ immediately and wash exposed skin.
5. Avoid ________________ sprays, dusts or vapors.
6. If chemical gets into eyes, flush eyes with water for________ minutes and get medical attention.
7. If chemicals are accidentally swallowed or if illness or other reaction occurs shortly after chemical use, ________________ ________________________________

**OBJECTIVE 11**

**Complete statements about the importance of protective clothing and equipment.** Write the correct words in the blanks.

1. Raincoat or waterproof apron to prevent wet-application materials from soaking into clothing and contacting
2. Goggles or face shield protects eyes and face from ________________________________.
3. Respirator protects ________ from chemical burn and protects applicator from possible ________ ________.
4. ________ hat or ________ hat to protects scalp from contamination.
5. Overalls or ________________ shirt and long pants to avoid contact with the skin.

6. Boots of ____________________ neoprene to protect feet and ankles.

7. Gloves of ____________________ neoprene to protect hands.

8. Gloves must be long enough to protect __________________.

9. Shirt cuffs should be worn ____________________ gloves so that chemicals will not be absorbed in the cloth and contact skin.

**OBJECTIVE 12**

**Match pesticide information to a sample pesticide label.** Write the correct names in the blanks on the label shown on the next pages.

Ingredient statement

Net contents

Name and address of manufacturer

Registration and establishment numbers

Use classification

Directions for use

Precautionary statement

Signal words and symbols

Trade or brand name

Common name

Chemical name

Re-entry statement

Storage and disposal directions

Physical or chemical hazards

Statement of practical treatment

# D·z·n®

1. ______________________________

**Active Ingredients:**
**O, O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate..................48%**

2. ______________________________

## Five Gallons

**U.S. Standard Measure**

3. ______________________________

## Warning

**See additional warning statements left of container seam.**

4. ______________________________

**EPA Est. 100-AL-1**
**EPA Reg. No. 100-461**

**Control No. 52200**

**See directions for use on panel at right.**

5. ______________________________

## Insecticide

**For control of certain insects on fruits, nuts, vegetables, field crops, and ornamentals**

**Sample label used with permission of CIBA-GEIGY Corporation**

# Diazinon AG500

6. ______________________

| **Active Ingredients:** | |
|---|---|
| **O, O-diethyl O-(2-isopropyl-phosphorothioate** | **48%** |
| **Xylene** | **36%** |
| **Inert Ingredients:** | **16%** |
| **Total:** | **100%** |

7. ______________________

## Directions for Use

**It is a violation of federal law to use this product in a manner inconsistent with its labeling.**

8. ______________________

## Fruit and Nut Crops

**Note: Unless otherwise stated, the following rates should be applied as a dilute full cover spray.**

**Almonds**
Mites, Twig Borers: Apply 1-1½ pts. per 100 gals. of water.

Parlatoria Scales, San Jose Scales: Mix 1-1½ pts. D•z•n Diazinon AG500 plus 2-3 gals. dormant oil per 100 gals. of water and apply as a dormant spray.

Almond hulls may be used for feed for livestock.

9. ______________________

**Note:** The California Department of Agriculture has set a 5-day reentry for Diazinon on citrus, grapes, peaches, and nectarines. Five days should elapse between the time of application and the time a worker may enter the field to engage in any activity requiring substantial contact with treated foliage. When a mixture of two or more organic phosphate pesticides is applied, the interval shall be prolonged by adding to the longest applicable interval an additional 50% of that interval.

10. ______________________

### Statement of Practical Treatment

If swallowed, call a physician immediately. DO NOT INDUCE VOMITING UNLESS NO OTHER TREATMENT IS AVAILABLE. Vomiting may cause aspiration pneumonia. If it is necessary to induce vomiting, give victim one or two glasses of water and insert finger in back of throat. Repeat until vomit fluid is clear. Do not induce vomiting or give anything by mouth to an unconscious person.

If inhaled, remove victim to fresh air and apply artificial respiration if indicated.

If on skin, wash promptly with soap and water. Rinse thoroughly.

If in eyes, rinse eyes for at least 15 minutes with water and call a physician immediately.

**Note to Physician:** Gastric lavage is indicated. Atropine sulfate and 2-PAM are specific antidotes.

### Environmental Hazards

This product is toxic to fish, birds, and other wildlife. Birds feeding on treated areas may be killed. Keep out of lakes, streams, ponds, tidal marshes, and estuaries (except for affluence from treated watercress beds). Do not apply to water that will be used for recreational purposes and human and livestock consumption. Shrimp and crab may be killed at application rates recommended on this label. Do not apply where fish, shrimp, crab, and other aquatic life are important resources. This product must not be used in areas where impact on threatened endangered species is likely. Contact your State Fish and Game Agency for information pertaining to areas having threatened endangered species. Apply this product only as specified on this label.

This pesticide is highly toxic to bees exposed to direct treatment or to residues remaining on the treated area. Do not apply when bees are actively visiting the crop, cover crop, or weeds blooming in the treatment area. Applications should be limited to provide the maximum possible interval between treatment and the next period of bee activity.

11. ______________________________

### Physical or Chemical Hazards

Do not use, pour, spill, or store near heat or open flame.

12. ______________________________

## Storage and Disposal

Do not contaminate water, food, or feed by storage or disposal. Open dumping is prohibited. Pesticide, spray mixture, or rinsate that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies. Reseal container and offer for reconditioning, or triple rinse (or equivalent) and offer for recycling, reconditioning, or disposal in approved landfill, or bury in a safe place. Consult federal, state, or local disposal authorities for approved alternative procedures.

13. ______________________________

## Precautionary Statements

### Hazards to Humans and Domestic Animals

**WARNING**

May be fatal if swallowed. May be absorbed through skin. Do not breathe spray mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Avoid contamination of food. Do not use on humans or permit children to go onto sprayed grass until spray has completely dried.

Keep out of reach of domestic animals. Do not contaminate feed or use on household pets or livestock. Do not permit pets to go onto sprayed grass until spray has completely dried.

14. ______________________________

Agricultural Division
CIBA-GEIGY Corporation
Greensboro, NC 27409
CGA 1L83C 060

15. ______________________________

**OBJECTIVE 13**

**Select from a list true statements concerning rules for chemical storage.** Write an "X" in the blank before each true statement.

____1. Keep chemicals labeled and sealed.

____2. Transfer chemicals in paper sacks to plastic or metal containers.

____3. Store chemicals on high shelves.

____4. Location of stored chemicals must be on file with the fire department.

____5. Store chemicals in original containers.

____6. Store herbicides, fungicides, insecticides, etc., in metal containers only.

____7. Store chemicals on concrete floor.

____8. Store chemicals in safe, dry area.

____9. Keep chemicals for a short time only.

___10. Store chemicals in tightly closed area.

___11. Don't accept chemicals without their MSDSs.

___ Keep hazardous chemicals in a locked room or cabinet.

___13. Dispose of old chemicals and containers.

___14. Keep hazardous chemicals cool and dry.

___15. Never store chemicals near food (animal or human), medicine or cleaning supplies.

___16. Vent hazardous chemicals to the outside.

___17. Store chemicals in cool, dark area.

___18. Post proper warning signs.

**OBJECTIVE 14**

**Select from a list true statements concerning guidelines for hazardous waste disposal.** Write an "X" in the blank before each true statement.

___ 1. Follow disposal instructions on container.

___ 2. Pour into marked container.

___ 3. Mix only what is needed to avoid disposal of surplus chemicals.

___ 4. When instructions are to bury surplus, drain tank in a pit dug in clay soil away from water sources.

___ 5. Use only metal containers and funnels.

___ 6. Do not dispose of empty containers or surplus chemicals where they may be a hazard to fish or wildlife or contaminate water.

___ 7. Do not save or reuse empty chemical containers.

___ 8. Clean empty containers thoroughly.

___ 9. When instructions are to bury surplus, drain tank in a pit dug in sandy soil away from water sources.

___ 10. Wrap containers in plastic before disposal.

___ 11. Dispose of containers promptly.

___ 12. Flush in toilet or pour down a drain and follow with plenty of water.

**OBJECTIVE 15**

**Match types of spray equipment to their correct uses.**
Write the correct letters in the blanks.

____1. Sprays a mist; used for high concentrate applications; allows applicator to travel through the greenhouse or outside areas; not used for herbicides

____2. Used for larger areas and for high chemical-water ratio applications; available in canister or backpack models

____3. Used for spot treatments and homeowner applications

____4. For greenhouse use; pressure sprayer with a pump; adjustable nozzles for spraying from fine mist to high-pressure jet stream

____5. Used to cover large outdoor areas; can be gasoline or electric, pull-type, self-powered or truck mounted

____6. Type of commercial lawn sprayer; used for large areas; breaks spray into a fine mist; gasoline-powered; carried on or towed by a truck; not used for herbicides

____7. For greenhouse use; sprays a fog; applies super-concentrated materials without much water; economical to use

____8. Used for low chemical-water ratio applications

a. Commercial lawn sprayers

b. Low-pressure sprayers

c. Hose-end sprayers

d. Wand applicators

e. High-pressure sprayers

f. Aerosol sprayers

g. Back pack mist blowers

h. Compressed air sprayers

i. Hand-spray pumps

j. ULV (Ultra-low volume) sprayers

k. Fumigators

l. Portable electric sprayers

**OBJECTIVE 16**

**Select from a list true statements about the information on a hazardous materials classification card.** Write an "X" in the blank before each correct statement.

___ 1. The red triangle describes specific hazards

___ 2. 3 in a blue triangle means an extreme danger to health

___ 3. 2 on the reactivity triangle means a substance may detonate

___ 4. 4 on the red triangle means violent chemical reaction is possible

___ 5. The yellow triangle means reactivity

___ 6. O in the red triangle means a substance will not burn

___ 7. OXY means oxygen is present

___ 8. 3 in the red triangle means the flash-point is below 100° F

___ 9. 2 in the blue triangle means a substance is hazardous, a person should use breathing apparatus

___ 10. ☢ Means an alarm system is in operation

___ 11. ~~W~~ Means no water is to be used

___ 12. 1 on the white triangle means a low-danger specific hazard

**NOTICE** The following assignment sheet and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 17** Complete safety test on reading chemical labels with 100 percent competency. SCORE ________

**OBJECTIVE 18** Demonstrate the ability to

a. Clean chemical containers for disposal. RATING ________

b. Clean spray equipment after pesticide use. RATING ________

c. Clean spray equipment after herbicide use. RATING ________

**WRITTEN TEST ANSWERS**

## CHEMICAL SAFETY

## X

**OBJECTIVE 1**

1. g
2. u
3. a
4. k
5. t
6. r
7. e
8. j
9. m
10. p
11. q
12. c
13. f
14. d

**OBJECTIVE 2**

Used as directed,

| Class | Level of Toxicity | harnful to humns, animals or environment? | Identification symbol | Restricted Use? |
|---|---|---|---|---|
| I | High | yes | DANGER, POISON<br>skull and crossbones | maybe |
| II | Moderate | yes | WARNING | yes |
| III | Slight | no | CAUTION | maybe |
| IV | Relatively non-toxic | no | CAUTION | no |

**OBJECTIVE 3**

1. p
2. r
3. c
4. h
5. j
6. q
7. f
8. o
9. d
10. g
11. k
12. n
13. m

**OBJECTIVE 4**

1. i
2. d
3. f
4. k
5. h
6. b
7. c
8. l

**OBJECTIVE 5**

1. j
2. h
3. c
4. a
5. g
6. b
7. f
8. e
9. m
10. i

**OBJECTIVE 6**

1. C
2. A
3. C
4. C
5. A
6. C
7. A

**OBJECTIVE 7**

1. Oral toxicity—Poisoning in or through the mouth
2. Dermal toxicity—Poisoning on or through the skin
3. Inhalation toxicity—Poisoning by breathing in fumes or particles

**OBJECTIVE 8**

Answers may include any three of the following from each category:

1. Mild poisoning—Irritation of the skin, nose, throat, and eyes; weakness, dizziness, headache, nausea, diarrhea

2. Moderate poisoning—Difficult breathing, blurred vision, rapid pulse, flushed skin, stomach cramps, vomiting, muscle twitches, poor muscle coordination, constricted pupils

3. Severe poisoning—Convulsions, loss of consciousness, secretions from nose and mouth, inability to breathe, often accompanied by fever; may be fatal

**OBJECTIVE 9**

Answer may include any ten of the following:

- Follow all directions on the label
- Do not spray outdoors on windy days
- Spray chemicals away from animals and humans
- Do not apply chemicals near water sources, nor near rainfall or irrigation runoff
- Check label for reentry and harvest regulations
- Mix chemicals outdoors or in a well-ventilated area
- Avoid pressure-release fumes or contact with the material
- Use the proper amount of chemical
- Do not mix chemicals unless allowed by label directions
- Keep records of all injuries
- Provide proper storage

**OBJECTIVE 10**

1. protective clothing
2. eat, drink, smoke
3. soap and water
4. remove clothing
5. inhaling
6. 10-15
7. get immediate medical attention or call a poison control center; have chemical label by the phone or take it to the doctor or hospital

**OBJECTIVE 11**

1. skin
2. chemical burns
3. lungs, brain damage
4. hard, waterproof
5. long-sleeved
6. unlined
7. unlined
8. wrists
9. outside

**OBJECTIVE 12**

1. Trade or brand name
2. Chemical name
3. Net contents
4. Signal words and symbols
5. Registration and establishment numbers
6. Common name
7. Ingredient statement
8. Use classification
9. Directions for use
10. Reentry statement
11. Statement of practical treatment
12. Physical or chemical hazards
13. Storage and disposal directions
14. Precautionary statement
15. Name and address of manufacturer

| | |
|---|---|
| **OBJECTIVE 13** | 1, 4, 5, 8, 9, 11, 12, 13, 15, 16, 18 |
| **OBJECTIVE 14** | 1, 3, 6, 7, 8, 9, 11 |
| **OBJECTIVE 15** | 1. g<br>2. h<br>3. f<br>4. l<br>5. a<br>6. e<br>7. j<br>8. c |
| **OBJECTIVE 16** | 2, 5, 6, 8, 9, 11 |
| **OBJECTIVE 17** | Refer to answers to Assignment Sheet 1. |
| **OBJECTIVE 18** | Refer to Practical Tests for Job Sheets 1, 2, and 3. |

## OBJECTIVE SHEET

# INTRODUCTION TO PLANT GROWTH MEDIA

## XI

### INTRODUCTION

The soil mix, or medium, for a plant is its source of food, water, and support. Whether you are planting seeds or repotting young trees, the soil mix you choose will have an important effect on the health, vitality, and appearance of the plant or crop. It could be said that the success and reliability of the medium is a key factor in the success of greenhouse and nursery crop production. There are many "common" formulas and a smaller number of special formulas for specific plants or specific desired results. This unit is an introduction to plant growth media, and it is a subject that you will continue to learn and experiment with throughout your career in horticulture.

### UNIT OBJECTIVE

After completing this unit, the student should have a working knowledge of pH values and the requirements and characteristics of plant media. The student will demonstrate these competencies by completing an assignment sheet, job sheet, practical test, and written test with a minimum of 85 percent accuracy.

### SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with plant growth media to their correct definitions.
2. Select from a list true statements about the importance of pH values.
3. Describe requirements for a good plant medium.
4. Select from a list true statements about porosity.
5. Match characteristics of materials used in mixing soil media to their correct descriptions.
6. Describe the advantages of a soilless mixture.
7. Compare plant growth in different media mixes. (Assignment sheet 1)
8. Mix 1:1:1 soilless media. (Job sheet 1)

**SUGGESTED ACTIVITIES**

# INTRODUCTION TO PLANT GROWTH MEDIA

## XI

**PREPARATION**

- Review unit and plan presentation.
- Order materials to supplement unit.
- Obtain or organize a variety of media materials to demonstrate different mixes.
- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.

**DELIVERY**

**Objective 1**

- Review terms and definitions with students.
- Have students collect samples of organic matter, inorganic matter and humus.
- Demonstrate aeration and porosity with gravel, marbles or chalkboard drawings, showing spaces filled with water and air.

**Objective 2**

- Refer to Unit IV, *Elementary Study of Soils*, for additional information and visual aids for learning about pH.
- Show students a pH table and have them each look up the pH value for one or two plants in your greenhouse.
- Compare the value of proper pH in plants to the value of proper human nourishment and the body's ability to use nutrients.

**Objectives 3 and 4**

- Discuss how different medium characteristics are desirable for different types of plants and different stages of growth.
- Demonstrate moisture retention, porosity, shrinkage, and swelling with various mixes placed in glass jars for visibility.

**Objectives 5 and 6**

- Show students the types of media materials used in your program. Allow them to handle the various materials and identify them by sight.
- Have identification competitions to differentiate peat moss, sphagnum moss, perlite, vermiculite, masonry sand vs. construction sand; building perlite and vermiculite vs. horticultural perlite and vermiculite, etc.
- Distribute Supplement 1—Common Media Mixes
- Give students opportunities to practice mixing media.
- Have students complete Job Sheet 1—Mix 1:1:1 soilless media.
- After students have demonstrated competency in mixing media, allow them to work individually, in groups or as a class to test various media mixtures. Have students plant or transplant the same plants into different formulas and watch growth progress.

  EXAMPLES: 1/2 peat, 1/4 vermiculite, 1/4 perlite
  1/3 soil, 1/3 peat, 1/3 perlite
  1/2 fine sand 1/2 peat
  all fine sand
  all compost or yard soil
  1/5 each of peat, sphagnum moss, vermiculite, perlite and sand

- Have students complete Assignment Sheet 1. Have students observe changes in growth, leaves, flowers and roots and write result reports. Have them compare results and determine the effects of each mix. Make sure accurate records are kept for you to use as basis for evaluating results.

**APPLICATION**

**Objective 7**

- Use Assignment Sheet 1—Compare plant growth in different media mixes to demonstrate how media affects plant growth and to teach the student to watch for differences in growth.

**Objective 8**

- Job Sheet 1—Mix 1:1:1 soilless media gives students the opportunity to use measuring and proportion and to test moisture level by feel.

**EVALUATION**

**Practical test**

- Determine if student followed correct procedure on each job sheet.
- Evaluate the quality of each product using the criteria given.
- Demonstrate the procedure again and retest if necessary.

**Written test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Publications**

- *The Commercial Greenhouse* by James W. Boodley. Cover job opportunities, growing structure, media, environmental factors, nutrition, propagation, harvesting, and more. Order No. 119. Available from American Nurseryman Publishing Co., telephone 1-800-621-5727.

## UNIT REFERENCES

- *Horticultural Occupations*, College Station, Texas: Texas A & M University, Instructional Materials Service, 1985.
- Reiley, H. Edward & Carroll L. Shry, Jr., *Introductory Horticulture*, 3rd edition. Albany, N.Y.: Delmar, 1988.
- Rodale, J.I. *Encyclopedia of Organic Gardening*. Emmaus, Penn: Rodale Press, 1986.

INFORMATION SHEET

# INTRODUCTION TO PLANT GROWTH MEDIA

# XI

**OBJECTIVE 1**

**Match terms associated with plant growth media to their correct definitions.**

- **Medium**—Mixture of several materials used for growing plants in containers; may or may not contain soil

  NOTE: The plural of medium is media.

- **Soluble**—Will dissolve in water

- **Available**—Can be absorbed and used by the plant

- **Microorganisms**—Microscopic plant or animal life such as fungi, bacteria, viruses, nematodes, and others

  NOTE: Millions of microorganisms and many kinds of microorganisms live in the surface layers of soil. Helpful bacteria, fungi, actinomycetes (ak-tin-oh-my-**cee**-tees), worms, and insects break down and digest organic matter, adding enzymes to the soil. Other microorganisms such as phages, viruses, nematodes, and damaging bacteria and fungi can cause plant disease and death.

- **Porosity**—Air spaces (pores) between solid particles of soil or medium

- **Compost**—Organic fertilizer, decomposed into rich, dark soil material called humus

- **Organic matter**—Decomposing remains of plants and animals added to soil or medium to loosen the texture and hold water

  EXAMPLES: Sawdust, bark, leaf mold, manure, compost, grass clippings

- **Inorganic matter**—Containing no organic particles

  EXAMPLES: Sand, gravel, perlite, vermiculite

- **Aeration**—Movement of air in and through the soil

**OBJECTIVE 2**

**Select from a list true statements about the importance of pH values.**

- **pH value**—is the measure of acidity (acid) or alkalinity (base) of the plant medium. pH is measured on a scale of 0 to 14, with a pH of 7 as neutral pH value. Values below 7 are acid and values above 7 are alkaline.

0 1 2 3 4 5 6 | 7 | 8 9 10 11 12 13 14

| Acid | Neutral | Alkaline |
|---|---|---|
| Azaleas | Hyacinth | Daylily |
| 4.5-5.5 | 6.5-7.5 | 6.0 (acid) to 8.0 |

- Each species has a proper, or preferred, pH range in which it grows best. Proper pH enables plants to use fertilizer and nutrients. When the pH is within the proper range, nutrients in the medium are unlocked and available to the plant. If the pH is too low or too high, the plant can't absorb the nutrients, even from fertilizer. If the medium or soil pH is wrong for the plant, fertilizer applications are wasted.

- Most minerals are more soluble in acid media than in alkaline media. Many plants grow faster and produce more fruit and flowers in a slightly acid-to-neutral medium, from about 6.0 to 7.5. Very few, if any, plants will grow at alkaline levels above 8 or at acid levels below 4.5.

- High acid pH:
  - Soils have high or toxic concentrations of aluminum and manganese
  - Reduces beneficial microorganisms that decompose organic matter in soils or media

- High alkaline pH:
  - If over 8.5, soils have high concentrations of sodium that can cause reduced growth or death of plant
  - Reduces solubility of all micronutrients in soils or media

**OBJECTIVE 3**

**Describe requirements for a good plant medium.**

- **Proper pH for crop**—Enables plants to have optimum nutrient uptake to promote growth, foliage and flower production, and resistance to disease

- **Moisture retention**—Holds water and at the same time releases excess water

- **Nutrient retention**—Must be able to hold and release nutrients to maintain pH value and for efficient use of fertilizers

- **Good porosity**—Provides good air and water exchange; will not pack and allows good water movement (See Objective 4)

  NOTE: Moisture retention, nutrient retention, and porosity are sometimes considered as storage or reservoirs for water, plant food, and oxygen.

- **Sterile**—Is free from insects and diseases

  NOTE: Sterilized media are used inside greenhouses, but are impractical for outdoor soils. Any time soil or sand is used for growing in containers it should be pasteurized—heated to 180° F. for 30 minutes. Commercial media mixes are already sterilized.

- **Good support for plant material**—Should be dense enough that plants will stand up. A mix that is too lightweight requires additional labor and materials to provide needed support for the plant. It can also reduce the shelf-life and shipping tolerance of the plant

  EXAMPLE: A bedding plant mix is lighter in weight than a mix that supports a tall, heavy plant

- **Little shrinkage and swelling**—Volume remains constant; there is no space between the soil ball and the pot when media is dry and no expansion when wet

- **Medium is reproducible**—A grower must be able to make and use the same mix season after season to insure consistent production and quality

**OBJECTIVE 4** **Select from a list true statements about porosity.**

- A good, porous soil provides good drainage. The right amount of water stays in the soil and excess water flows out.

- Porous soil provides aeration. Air spaces between particles allow the roots to breathe.

- If a mix is too tight, it will hold too much water and encourage root rot or other diseases. Excess water slows the release of nitrogen, depletes mineral nutrients, and hinders plant growth.

- If mix is too loose, too much air is present and water will drain quickly. The crop will require frequent heavy watering, increasing labor and water costs and nutrient loss. Excess air speeds nitrogen release beyond the plant's ability to absorb it and much of it is lost.

**OBJECTIVE 5**

**Match characteristics of materials used in mixing soil media to their correct descriptions.**

- **Organic matter**

  NOTE: Leaf mold, compost, and sawdust are common and popular organic materials used for home gardens and greenhouses, but they are not used in commercial greenhouses or nurseries because they contain seeds and toxins.

  - **Peat moss**—Partially decomposed plant matter; has high water retention, absorbing 15 to 20 times its dry weight in water; has high nutrient retention; has a pH reading of 4.0 to 4.5

    NOTE: Peat forms under water and is preserved by water. It is collected from marshes, bogs, and swamps. As with any crop, the peat harvest can be plentiful or scarce according to climate conditions.

  - **Sphagnum moss**—(**sfag**-num) Dehydrated stems and leaves of acid bog plants; shredded and used to cover seeds; good water retention, absorbing 10 to 20 times its dry weight in water; is lightweight; is relatively sterile and controls disease well; contains 95 to 99% pure organic matter; has a pH of 3.0 to 4.5

    NOTE: Sphagnum is a type of peat moss. Reed and sedge mosses are similar to peats, but grow in shallow areas around the edges of water-filled areas and in boggy meadows. This group of mosses is not as popular as peat and sphagnum moss, but is preferred by some horticulturists.

  - **Pine bark**—Broken into small pieces of 1/4" or smaller; absorbs nutrients and releases them slowly; decomposes slowly; has a pH of 3.5 to 3.7

    NOTE: Most mixtures that use tree bark use pine, although some use oak bark. Redwood and fir barks are less popular. Nurseries use tree bark more frequently than greenhouses do.

- **Natural soils**
  - **Topsoil**—Uppermost layer of soil, consisting of air, water, minerals and organic matter
  - **Masonry or plaster sand**—Sharp, coarse particles, .5 to 2.0 mm in diameter; heaviest media material used; must be cleaned and sterilized before use; does not hold water and contains very few nutrients
  - **Loam**—Mixture of approximately equal parts of sand, silt and clay; most desirable soil for general use; good porosity
- **Inorganic media materials**
  - **Perlite**—Volcanic rock crushed and heated to 1800° F.; used to improve aeration; holds 3 to 4 times its dry weight in water; will not hold nutrients; has a neutral pH

    NOTE: Perlite is manufactured as building and horticultural grades. Horticultural grade has larger particles and provides better drainage and aeration.
  - **Vermiculite**—Mica compound heated to 2,000° F.; used to improve moisture retention; absorbs 3 to 4 gallons of water per cubic foot; absorbs and gradually releases nutrients; has a neutral pH

    NOTE: Vermiculite is manufactured as horticultural grades and building/construction grades. Construction grade is *not* suitable for growing media.
- **Nutrients and additives**—Fertilizers and chemicals used to provide a medium to meet the nutritional and pH requirements for specific growth periods or specific crops

  NOTE: These materials are also called *soil additives* or *soil amendments*.

  EXAMPLES: Superphosphate, dolomitic limestone, calcium or potassium nitrate, trace elements, gypsum, calcium carbonate lime, potassium sulfate, chelated iron, etc.
- **Slow-release fertilizers**—Plant food that is made available to plants gradually, over a 3 to 4, 8 to 9 or 12 to 14 month period

  EXAMPLE: Osmocote® brand fertilizer

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- **Wetting agents**—Chemicals that change the physical properties of water and other liquids, increasing absorption and making liquids spread evenly throughout media or on plant surfaces; used to improve the first watering of dry peat moss, which is usually waxy and water-repellent and to hold water and improve wetness in root zones; reduces amount of water required

  EXAMPLES: Aqua-Gro, Supersorb, Surfside brands

  NOTE: Wetting agents are also called "surfacants" because they break apart the surface structure of liquids.

**OBJECTIVE 6** **Describe the advantages of a soilless mixture.**

NOTE: The advantages of soilless mixtures far outweigh the disadvantages. The disadvantages are that the mixture is lightweight and can blow over outdoors; nutrients must be provided; and some plants, such as rhododendrons and azaleas, do not transplant easily from media to soils.

Soilless mixtures were developed because of the growing shortage of good horticulture-grade natural soils. Agricultural and roadside soils have been treated with herbicides; construction materials and mineral salts are harmful to plants; soil is heavy to ship and not reliable in quality.

### ADVANTAGES

- Uniform, does not vary in fertility, pH, or texture
- Lightweight, easy to handle and ship
- Good moisture retention and drainage can be achieved through proper mixture of ingredients
- Ingredients are sterile
- Nutrients are released slowly
- Usually cheaper than soil
- Desirable response with specific crops is more controllable

## COMMON MEDIA MIXES

### 1:1:1 GENERAL PURPOSE

1 part perlite
1 part vermiculite
1 part sphagnum moss

### TROPICAL MIX

1 part perlite, vermiculite or sterile masonry sand
1 part loam
1 part organic matter

### PRO MIX

Commercial preparation, comes mixed, sterilized, and ready to use. Different mixtures contain various proportions of sphagnum moss, perlite, and vermiculite.

### OSU MIX

*Mix*:

1 cu ft peat
1/2 cu ft of each of the following:

- Pine bark mulch
- Sterilized masonry sand
- Coarse perlite
- Coarse vermiculite
- Enough water to moisten—approx. 1/3 cu ft

*Add*:

504 gms dolomite limestone
126 gms single superphosphate (0-20-0)
99 gms potassium nitrate
9 gms fritted trace elements Peters' No. 555 or 503

# INTRODUCTION TO PLANT GROWTH MEDIA

**OBJECTIVE 7**

**Compare plant growth in different media mixes.**

Name of individual or group ______________ Score _________

**INTRODUCTION**

See for yourself how different mixes affect plant growth. After you have completed Job Sheet 1 and know how to mix media, you can test how different combinations fulfill or fail the requirements of a good mix:

- Proper pH for the crop
- Moisture retention
- Nutrient retention
- Good porosity
- Sterility
- Support for plant material

**DIRECTIONS**

Your teacher will assign media mix formulas for you or for your group and will assign seedlings to be transplanted into the mix or mixes. You are to watch the plants grow for 12 days, recording all changes you observe.

At the end of the twelve days, describe what effect you think the medium has had on the growth of the plants.

**DATA**

Formulas of soil mix used:

Type of plant ________ No. of plants ________

Circle one: Seedling Transplant Root cutting

Date experiment begins ______________________________

## OBSERVATIONS

Note and record seedling or plant height, color, uprightness; any changes in leaves, flowering or roots (pull one plant each observation day and note condition of roots), amount of water required.

DAY 1

________________________________________

________________________________________

________________________________________

DAY 3

________________________________________

________________________________________

________________________________________

DAY 6

________________________________________

________________________________________

________________________________________

DAY 9

________________________________________

________________________________________

________________________________________

________________________________________

DAY 12

________________________________________

________________________________________

________________________________________

________________________________________

## CONCLUSIONS

Date:

Signed:

**ASSIGNMENT SHEET 1**

Results will vary from group to group, experiment to experiment.

The collection of data and explanation of conclusions about data collected are the important criteria to be evaluated. Did the student use the appropriate techniques?

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# JOB SHEET 1 — INTRODUCTION TO PLANT GROWTH MEDIA — XI

**OBJECTIVE 8**

**Mix 1:1:1 soilless media.**

**NOTE:** Mixture can be made in a wheelbarrow or in smaller amounts.

**TOOLS AND MATERIALS**

- Sphagnum moss
- Perlite
- Vermiculite
- Equal-sized containers; For example

  Individual amounts: styrofoam or paper cups

  Wheelbarrow: 1- or 5-gallon buckets
- Mixing tools:

  Individual amounts—Spoons

  Wheelbarrow—Shovel and garden hoe
- Individual amounts—bowls, jars, coffee cans, etc. or mixing table

  Wheelbarrow
- Water
- Storage containers

**PROCEDURE**

*Individual amounts*

1. Put one measure each of sphagnum moss, perlite, and vermiculite into container or into a pile on mixing table.
2. Combine ingredients and stir thoroughly.
3. Add a small amount of water and mix throughout the medium.
4. Test for moisture: Squeeze a handful of medium; if moisture level is correct, it will form into a solid mass.
5. Add water as needed until squeezed handful forms into a solid mass.

6. Have your instructor check your work.

7. Place medium in storage container and store properly.

8. Put away tools and materials and clean the work area.

*Wheelbarrow*

1. Measure one container each of sphagnum moss, perlite, and vermiculite into wheelbarrow.

2. Mix ingredients with shovel or hoe until well blended.

3. Add a small amount of water to ingredients and mix throughout the medium.

4. Test for moisture: Squeeze a handful of medium; if moisture level is correct, it will form into a solid mass.

5. Add water as needed until a squeezed handful of media will form into a solid mass.

6. Have your instructor check your work.

7. Place medium in storage containers and store properly.

8. Put away tools and materials and clean the work area.

**PRACTICAL TEST 1**

## INTRODUCTION TO PLANT GROWTH MEDIA

## XI

**JOB SHEET 1**

**Mix 1:1:1 soilless media.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

*Individual amounts*

| The student: | YES | NO |
|---|---|---|
| 1. Put one measure each of sphagnum moss, perlite, and vermiculite into container or into a pile on mixing table. | | |
| 2. Combined and stirred ingredients thoroughly. | | |
| 3. Added a small amount of water and mixed throughout the medium. | | |
| 4. Tested for moisture (Should form into solid mass of medium). | | |
| 5. Added water as needed until squeezed handful formed into a solid mass. | | |
| 6. Placed medium in storage container and stored properly. | | |
| 7. Used proper tools correctly. | | |
| 8. Performed steps in a timely manner. | | |
| 9. Practiced safety rules throughout procedure. | | |
| 10. Provided satisfactory responses to questions asked. | | |
| 11. Put away tools and cleaned work area. | | |

*Wheelbarrow*

| The student: | YES | NO |
|---|---|---|
| 1. Measured one container each of sphagnum moss, perlite, and vermiculite into wheelbarrow. | ____ | ____ |
| 2. Mixed ingredients with shovel or hoe until well-blended. | ____ | ____ |
| 3. Added a small amount of water and mixed throughout the medium. | ____ | ____ |
| 4. Tested for moisture. | ____ | ____ |
| 5. Added water as needed until squeezed handful formed into a solid mass. | ____ | ____ |
| 6. Placed medium in storage containers and stored properly. | ____ | ____ |
| 7. Used proper tools correctly. | ____ | ____ |
| 8. Performed steps in a timely manner. | ____ | ____ |
| 9. Practiced safety rules throughout procedure. | ____ | ____ |
| 10. Provided satisfactory responses to questions asked. | ____ | ____ |
| 11. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Mixed<br>1:1:1<br>medium | 4 | 3 | 2 | 1 |
| Moisture<br>level | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

## INTRODUCTION TO PLANT GROWTH MEDIA

## XI

NAME ______________________ SCORE ________

**OBJECTIVE 1**

**Match terms associated with plant growth media to their correct definitions.** Write the correct letters in the blanks.

___ 1. Air spaces between solid particles of soil or medium

___ 2. Microscopic plant or animal life such as fungi, bacteria, viruses, nematodes and others

___ 3. Can be absorbed and used by the plant

___ 4. Decomposing remains of plants and animals added to soil or medium to loosen the texture and hold water

___ 5. Containing no organic particles

___ 6. Movement of air in and through the soil

___ 7. Will dissolve in water

___ 8. Mixture of several materials used for growing plants in containers; may or may not contain soil

___ 9. Organic fertilizer, decomposed into rich, dark soil material called humus

a. Aeration

b. Anorganic

c. Available

d. Compost

e. Decomposants

f. Fertilizer

g. Humusite

h. Inorganic matter

i. Medium

j. Microorganisms

k. Neutralizers

l. Organic matter

m. Porosity

n. Soluble

**OBJECTIVE 2**

**Select from a list true statements about the importance of pH values. Write an "X" in the blank before each true statement.**

____1. High alkaline soils, if over 8.5, have high concentrations of sodium that can cause reduced growth or death of plant

____2. Values below 7 are acid and values above 7 are alkaline

____3. High alkaline pH reduces solubility of all micronutrients in soils or media

____4. Proper pH enables plants to absorb water

____5. High acid pH soils can be neutralized by adding soil as alkaline as the acidity

____6. Proper pH enables plants to use fertilizer and nutrients

____7. pH is measured on a scale of 0 to 12, with a pH of 7 as neutral pH value

____8. High alkaline soils, if over 8.5, have high concentrations of calcium that can cause reduced growth or death of plant

____9. If the pH is too low or too high, the plant can't absorb the nutrients, even from fertilizer

___10. Most minerals are more soluble in alkaline media than in acid media

___11. pH value is the measure of acidity (acid) or alkalinity (base) of the plant medium

___12. Few, if any, plants will grow at alkaline levels above 9 or at acid levels below 5.5

___13. If the medium or soil pH is wrong for the plant, fertilizer applications are wasted

___14. High acid pH soils have high or toxic concentrations of aluminum and manganese

___15. Flowering plants grow faster and produce better colors with a neutral pH

___16. Many plants grow faster and produce more fruit and flowers in a slightly acid-to-neutral medium, from about 6.0 to 7.5

___17. Alkaline pH reduces beneficial microorganisms that decompose organic matter in soils or media

___18. Each species has a set pH level in which it grows best

**OBJECTIVE 3** Describe requirements for a good plant medium.

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**OBJECTIVE 4**

**Select from a list true statements about porosity.** Circle the correct answers.

1. When there is a depletion of mineral nutrients, hindered plant growth, and a slowed release of nitrogen, the plant has __________.
   a. Excess water
   b. Excess air
   c. Excess potassium
2. Air spaces between particles __________.
   a. allow the roots to breathe
   b. allow water to be absorbed
   c. hold nutrients for gradual release
3. When nitrogen is released beyond the plant's ability to absorb it and much of it is lost, it is said to have __________.
   a. Excess water
   b. Excess air
   c. Excess potassium
4. A good, porous soil provides good __________.
   a. drainage
   b. uptake of nutrients
   c. root systems
5. The right amount of water __________.
   a. is absorbed by the plant for each stage of growth
   b. stays in the soil, available to the plant
   c. stays in the soil and excess water flows out

6. When too much air is present and water drains quickly, the mix is too _________.

   a. loose

   b. heavy

   c. light

7. Porous soil provides _________.

   a. nitrogen

   b. aeration

   c. nutrient retention

8. Mix that holds too much water, which will eventually cause root rot or other disease, is considered too _________.

   a. loose

   b. heavy

   c. tight

**OBJECTIVE 5**

**Match characteristics of materials used in mixing soil media to their correct descriptions.** Write the correct letters in the blanks. (Question is continued on the following page). Answers may be used more than once.

____1. Fertilizers and chemicals used to provide a medium to meet the nutritional and pH requirements for specific growth periods or specific crops

____2. Volcanic rock crushed and heated to 1800° F.

____3. Is lightweight; is relatively sterile and controls disease well; contains 95 to 99% pure organic matter; has a pH of 3.0 to 4.5

____4. Used to improve aeration: holds 3 to 4 times its dry weight in water; will not hold nutrients; has a neutral pH

____5. Broken into small pieces of 1/4" or smaller; absorbs nutrients and releases them slowly; decomposes slowly; has a pH of 3.5 to 3.7

____6. Plant food that is made available to plants gradually, over a 3 to 4, 8 to 9, or 12 to 14 month period

____7. Dehydrated stems and leaves of acid bog plants; shredded and used to cover seeds; good water retention, absorbing 10 to 20 times its dry weight in water

____8. Uppermost layer of soil, consisting of air, water, minerals, and organic matter

____9. Must be cleaned and sterilized before use; does not hold water and contains very few nutrients

a. Bog moss

b. Construction perlite

c. Inorganic minerals

d. Natural soils

e. Nutrients and additives

f. Oak bark

g. Organic minerals

h. Pine Bark

i. Root additives

j. Slow-release fertilizers

k. Sphagnum moss

l. Topsoil

m. Construction vermiculite

n. Clay

o. Loam

p. Masonry or plaster sand

q. Peat moss

r. Perlite

__ 10. Chemicals that change the physical properties of water and other liquids, increasing absorption and making liquids spread evenly throughout media or on plant surfaces

__ 11. Mixture of approximately equal parts of sand, silt, and clay; most desirable soil for general use; good porosity

__ 12. Used to improve moisture retention; absorbs 3 to 4 gallons of water per cubic foot; absorbs and gradually releases nutrients; has a neutral pH

__ 13. Used to improve the first watering of dry peat moss, which is usually waxy and water-repellent and to hold water and improve wetness in root zones; reduces amount of water required

__ 14. Mica compound heated to 2,000° F

__ 15. Partially decomposed plant matter; has high water retention, absorbing 15 to 20 times its dry weight in water; has high nutrient retention; has a pH reading of 4.0 to 4.5

__ 16. Sharp, coarse particles, .5 to 2.0 mm in diameter; heaviest media material used

s. Soil amendments

t. Vermiculite

u. Water softner

v. Wetting agent

**OBJECTIVE 6** **Describe the advantages of a soilless mixture.**

**NOTICE** The following assignment sheet and job sheet are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 7** **Evaluate Results of Media Mix Experiments.** SCORE ________

**OBJECTIVE 8** **Mix 1:1:1 soilless media.** RATING ________

## WRITTEN TEST ANSWERS

## INTRODUCTION TO PLANT GROWTH MEDIA

## XI

**OBJECTIVE 1**

1. m
2. j
3. c
4. l
5. h
6. a
7. n
8. i
9. d

**OBJECTIVE 2**

1, 2, 3, 6, 9, 11, 13, 14, 16

**OBJECTIVE 3**

- **Proper pH for crop**—Enables plants to have optimum nutrient uptake to promote growth, foliage and flower production, and resistance to disease
- **Moisture retention**—Holds water and at the same time releases excess water
- **Nutrient retention**—Must be able to hold and release nutrients to maintain pH value and for efficient use of fertilizers
- **Good porosity**—Provides good air and water exchange; will not pack and allows good water movement (See Objective 4)
- **Sterile**—Is free from insects and diseases
- **Good support for plant material**—Should be dense enough that plants will stand up. A mix that is too lightweight requires additional labor and materials to provide needed support for the plant. It can also reduce the shelf-life and shipping tolerance of the plant.
- **Little shrinkage and swelling**—Volume remains constant; there is no space between the soil ball and the pot when media is dry and no expansion when wet
- **Medium is reproducible**—A grower must be able to make and use the same mix season after season to insure consistent production and quality

**OBJECTIVE 4**

1. a
2. a
3. b
4. a
5. c
6. a
7. b
8. c

**OBJECTIVE 5**

1. e
2. r
3. k
4. r
5. h
6. j
7. k
8. l
9. p
10. v
11. o
12. t
13. v
14. t
15. q
16. p

**OBJECTIVE 6**

- Uniform, does not vary in fertility, pH, or texture
- Lightweight, easy to handle and ship
- Good moisture retention and drainage can be achieved through proper mixture of ingredients
- Ingredients are sterile
- Nutrients are released slowly
- Usually cheaper than soil
- Desirable response with specific crops is more controllable

**OBJECTIVE 7** Refer to answers to Assignment Sheet 1. SCORE ________

**OBJECTIVE 8** Refer to Practical Test Rating for Job Sheet 1. RATING ______

**OBJECTIVE SHEET**

# ELEMENTARY STUDY OF SOILS

# XII

**INTRODUCTION**

The quality of soil is basic to all growing plants. Knowledge of soil formation, soil characteristics and pH value is essential for competent horticultural practices and for growing healthy, productive plants.

**UNIT OBJECTIVE**

After completing this unit, the student should describe the characteristics of soil types and particles and recommend treatment to adjust pH values. The student will demonstrate these competencies by completing assignments sheets, a job sheet, practical test, and written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with the elementary study of soils to their correct definitions.
2. Select from a list statements describing how soil is formed.
3. List composition ratios of an average soil particle.
4. Describe soil texture.
5. Distinguish among types of soil particles.
6. Explain how soil particle size affects the movement of water through soil.
7. Match types of soil water to their descriptions.
8. State pH values for soil types.
9. Distinguish between methods of adjusting soil pH.
10. Calculate soil type. (Assignment Sheet 1)
11. Recommend treatments for pH problems in soils. (Assignment Sheet 2)
12. Determine pH requirements of greenhouse and nursery plants. (Assignment Sheet 3)
13. Demonstrate the ability to test soil pH value with litmus paper. (Job Sheet 1)

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.

  NOTE: Students must complete Job Sheet 1—Test Soil pH Value with Litmus Paper, before they can complete Assignment Sheet 3, Determine pH Requirements of Greenhouse and Nursery Plants.
- Order materials to supplement unit.
- Invite a geologist or a County Extension Agent to speak to the class about soil and pH values.
- Invite a chemist or chemistry teacher, biologist, medical researcher, medical laboratory technician or other life-science expert to speak about the importance of pH and acid-base determination to all life forms.

  NOTE: Supply guest speakers with the Objective Sheet, Information Sheet and any other components you want them to cover.
- Contact a local university and request samples of bedrock, parent material, subsoil and topsoil.
- Obtain samples of sand, silt, clay and loam. Have enough of each type to demonstrate how soils combine and retain or drain water.
- Have pH tables available for students' use.
- Have samples of gypsum, agricultural lime, sulfur and aluminum sulfate to let students see, feel, and smell the different substances.

**DELIVERY**

**Objectives 1 and 2**

- Show *Soil and It's Properties* on soil formation.
- Discuss how the land you're on was probably formed.
- Invite a geologist to discuss the geological history and formation of the local area.

**Objectives 3 through 5**

- Demonstrate soil types. Allow students to handle soils dry and wet. Combine silt and loam to make silty loam, etc.
- Have students complete Assignment Sheet 1. Stress the importance of knowing how soil types are related and how soil type directly affects the horticultural crops discussed in your greenhouse or nursery operation.

**Objectives 6 and 7**

- Place different soil types in tall jars and pour water through so students can see the relationships between soil particle size and water movement, absorptions, and drainage.
- Demonstrate capillary action with a washcloth or rag. Put one end in a glass of water and the other end over the edge of the glass. Explain how water is drawn upward, fiber to fiber in the cloth, as the plant draws water up cell by cell.

**Objectives 8 and 9**

- Have students gather soil from different places in the community and test the pH values. Relate findings to movement of parent soils.
- Compare pH and nutrient availability to the human body's need for sunlight or Vitamin D in order to absorb and use Vitamin A.
- Distribute Supplement 1 on pH values. Discuss with students how to use the handout to determine pH range.
- Have students complete Assignment Sheet 2 and Job Sheet 1.
- Have students complete Assignment Sheet 3.

## APPLICATION

**Objective 10**

- Use Assignment Sheet 1 to give students practice in using a textural triangle. Review soil characteristics.

**Objectives 11 and 12**

- Have a guest speaker talk about the importance of pH in many areas of life.
- Demonstrate pH values with litmus paper and vinegar, baking soda, tomatoes, soda pop, soap, etc. Have students identify acid or alkaline by the red or blue color to reinforce recognition.
- Use Assignment Sheet 2 to help students learn what substances to add to soil to raise or lower pH.
- Use Assignment Sheet 3 in conjunction with Job Sheet 1 to give students a full-scope experience finding soil pH, identifying plant pH requirements, evaluating whether the soil pH is right for the plant or whether it should be raised or lowered, and what substances should be added to the soil to correct pH balance for specific plants.

**Objective 13**

- Use Job Sheet 1 to teach students how to determine soil pH using litmus paper. Tell students that litmus paper is available in drugstores and in chemistry departments.

## EVALUATION

**Practical test**

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

### Computer Software

- *Horticulture and Related Review*, for Apple computers, Hobar Publications, 1983. Approximately 500 questions in botany, soils and fertilizers, landscaping and outdoor plants, pruning and training, pest control, house plants, green house practices, plant propagation, fruits and vegetables. Order No. 201 PX for Apple II+, IIe. IIc - 5.25" for Apple II GS, 3.5". Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, OH 43210, telephone (614) 292-4848.

### Publications

- *Soil Fertility Manual*. Potash and Phosphate Institute, 1987. Covers soil fertility and productivity; soil reaction and liming, provision for nitrogen, phosphorus, potassium, secondary nutrients and micronutrients; soil testing, plant analysis and diagnostic techniques; and fertilizing for profit; includes review questions. 92 pages, loose-leaf with binder. Order No. 505X. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, OH 43210, telephone (614) 292-4848.
- *Soil and It's Properties*. 66 color slides and illustrated script. Ohio Curriculum Materials Service, 1988. Covers how we depend on the soil for our living and the types of work, including horticulture requiring knowledge of soil properties. Discusses soil properties: soil horizons, color and drainage, texture, structure, and soil water. Order No. 5008 S. Available from Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, OH 43210, telephone (614) 292-4848.

**UNIT REFERENCES**

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- Richardson, William B., and Moore, Gary B., *Working in Horticulture*. New York: Gregg Division/McGraw-Hill Book Company, 1980.
- *Soil Test Kits: Instructions for Use*. Sudbury, Mass: Sudbury Laboratory, Inc., nd.

# INFORMATION SHEET | ELEMENTARY STUDY OF SOILS XII

**OBJECTIVE 1**

**Match terms associated with the elementary study of soils to their correct definitions.**

- **Parent material**—Original rocky material before weathering has taken place
- **Minerals**—General term for inorganic material in the soil

  NOTE: Mineral matter usually contains 64 different elements as soil nutrients
- **Organic matter**—Plant and animal residues and remains
- **Lichens**—Mosslike plants consisting of algae and fungi; grow in clumps on rocks and tree trunks
- **Leach**—Water moving downward carries nutrients away from plant roots
- **Loam**—Soil containing sand, silt, clay, and organic matter
- **Topography**—Surface features of a region, including hills, valleys, rivers, lakes, mountains
- **pH value**—Measure of acidity or alkalinity of soil

**OBJECTIVE 2**

**Select from a list statements describing how soil is formed.**

- Soil formation begins as rock that is broken into smaller particles by snow, ice, wind, and rain. This first breakdown is the parent material.
- Lower plant forms such as lichens, moss and fungi grow on the rock particles then decompose adding organic matter to the rock particles so that higher plant forms can grow.
- As plant and animal matter break down and decay, they release chemical compounds essential for soil formation.
- Soil is further broken down by different types of weathering that change the consistency, chemical makeup, moisture content, and general composition.

- Physical weathering is soil breakdown caused by heating and cooling, freezing and thawing, wind, and water. Other factors such as glaciers and earth movements grind larger rocks into smaller ones.

- Chemical weathering is the reaction and interaction of water, oxygen, carbon dioxide, and other substances that act on soil particles.

- Climate, meaning temperature and rainfall, affects the rate of chemical reaction.

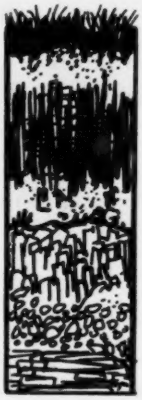
  EXAMPLE: In warmer climates, fungi and soil bacteria that help break down plant matter grow faster as do plants themselves.

- Topography
  - affects the breakdown of larger particles through runoff and gravity
  - causes particles to move up or down slopes and relocates the parent material
  - affects the amount of moisture in the soil through runoff and drainage

  NOTE: The parent material influences texture and natural fertility and carries those characteristics to the places it settles.

- These factors combine to create soils with different particle structures and sizes, particle types, amounts of organic and inorganic content, layers of soil, and pH values. (Figure 1)

FIGURE 1



Top soil - most weathered and usually the most productive layer

Subsoil - intermediate layer; originates from parent material

Parent material

Bedrock - solid rock beneath soil

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**OBJECTIVE 3** **List composition ratios of an average soil particle.**

NOTE: These amounts are the *average* ratios. Soil particle composition varies. Soil is made of solids—mineral and organic matter, liquid (water), and gas (air).

- Mineral matter—45%
- Water—25%
- Air—25%
- Organic matter 5%

FIGURE 2

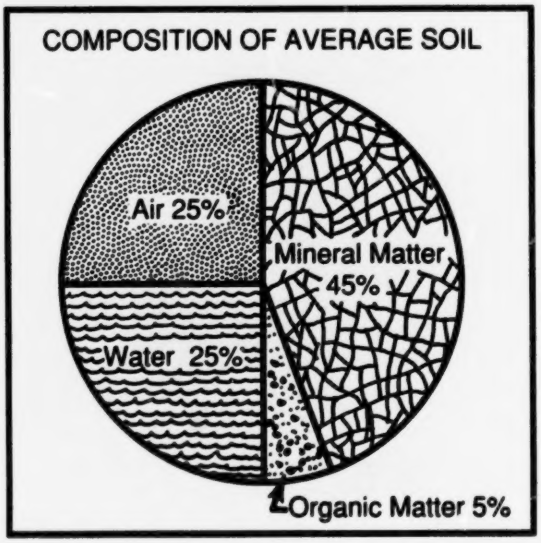


Illustration reprinted with permission of Texas A & M, 1985.

**OBJECTIVE 4** **Describe soil texture.**

- The soil texture refers to the size of the individual particles.

- Particles are classed according to size: (Figure 3)
  - Fine—clay
  - Medium—silt
  - Coarse—sand and gravel

FIGURE 3

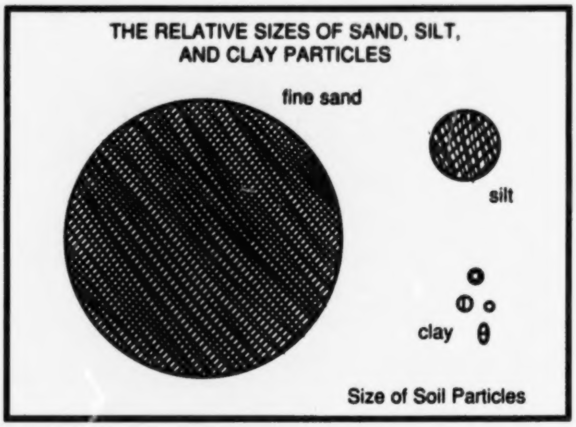

THE RELATIVE SIZES OF SAND, SILT, AND CLAY PARTICLES
fine sand
silt
clay
Size of Soil Particles

Illustration reprinted with permission of Texas A & M, 1985.

- Soil is a mixture of sand, silt and clay in the surface layer. The percentage of each type of particle determines the soil's ability to drain and hold water.

  EXAMPLES: Sandy soil: 100% sand, 0-15% silt, 0-10% clay
  Loam: 23-52% sand, 28-50% silt, 7-27% clay

**OBJECTIVE 5** **Distinguish among types of soil particles.**(Assignment Sheet 1)

**Sand**

- Largest soil particle
- Poor water retention
- Poor nutrient retention
- Drains quickly
- When dry, feels loose and single grained, gritty
- When wet, forms easily-crumbled ball

803

**Silt**

- Smaller in size than sand
- Good water retention
- Good nutrient retention
- When dry, feels smooth, soft and floury, shows fingerprints; makes hard-to-break clods
- When wet, feels smooth, slick like butter, stains fingers

**Clay**

- Smallest soil particle; microscopic
- Very good water retention
- Very good nutrient retention
- May hold water and nutrients so tightly that they are unavailable for plants
- Shrinks and expands dramatically as water varies, leaving soil cracked and cloddy
- When dry, extreme pressure is required to break clods by hand
- When wet, sticky and moveable, like modeling clay; stains fingers

  NOTE: A silty clay feels smooth; a sandy clay feels gritty.

**Loam**

NOTE: Loam soils vary in their structure. If the mineral content is half sand, it is called a sandy loam. If the content is half clay, it is called a clay loam.

- Good drainage and good moisture retention
- Provides 50% solid matter and 50% space between solids
- The space between solids is 50% water and 50% air
- When dry, feels mellow, somewhat gritty; clods are somewhat hard to break by hand
- When wet, feels neither very gritty nor very smooth; forms a firm ball; stains fingers

**OBJECTIVE 6** **Explain how soil particle size affects the movement of water through soil.**

- Water retention or draining depends on soil texture. The larger the particles of soil, the greater the space between them. Where space is available for water to flow, it will. The larger the particles, the faster water moves through the soil.

  EXAMPLE: Water moves slowly through clay and quickly through sand.

- As the water moves, it leaches nutrients which must be replenished with fertilizer.

  NOTE: Clay soils, because they hold moisture longer, also hold nutrients and require less fertilization than sandy soils. Sandy soils lose nutrients and require frequent fertilization.

**OBJECTIVE 7** **Match types of soil water to their descriptions.**

- **Capillary**—Water held by the soil and available to plants through their roots.

  NOTE: Capillary action of the roots pulls water up from the soil and through the plant. In the greenhouse, plants are placed on saucers or in tubs after transplanting so that roots have plenty of available water.

- **Gravitational**—Water that moves down and away from the surface by gravity, not used by plants.

  NOTE: Gravitational water flows right down past the roots leaching the nutrients from the soil.

- **Hygroscopic**—Water held so tightly in soil that it is unavailable to plants

  NOTE: Hygroscopic water is often found in clay soils.

**OBJECTIVE 8** **State pH values for soil types.**

NOTE: Plants grow best when their acid-alkaline requirements are properly met, usually within a range of pH values rather than at a fixed value. It is said that the plant "prefers" or "likes" a certain pH range. Most horticultural crops are adapted to a pH range just below neutral, 6.0 to 7.0. Some examples are broccoli, Easter lilies, and climbing roses.

- **Neutral soil**—pH of 7

  EXAMPLES: Primrose, *Forrestii* 6.5-7.5;
  Prickly pear, *Humifusa* 6.5-7.5;
  Pinks, *Petraeus* 6.5-7.5

- **Acid soil**—pH of 0-7

  **NOTE:** Many plants grow faster and produce more fruit in a slightly acid soil because plant food elements are more available at 6.0-7.0 pH levels.

  EXAMPLES: Dracaena 5.0-6.0;
  Strawberry 5.0-6.5;
  Pomegranate tree 5.5-6.5;
  also, azaleas, camellias,
  and gardenias

- **Alkaline soil**—pH of 7-14

  EXAMPLES: Wild rose 6.0-8.0;
  Sedum 6.0-8.0;
  Yucca 6.0-8.0;
  also clematis,
  scillas, and
  campanulas

FIGURE 4

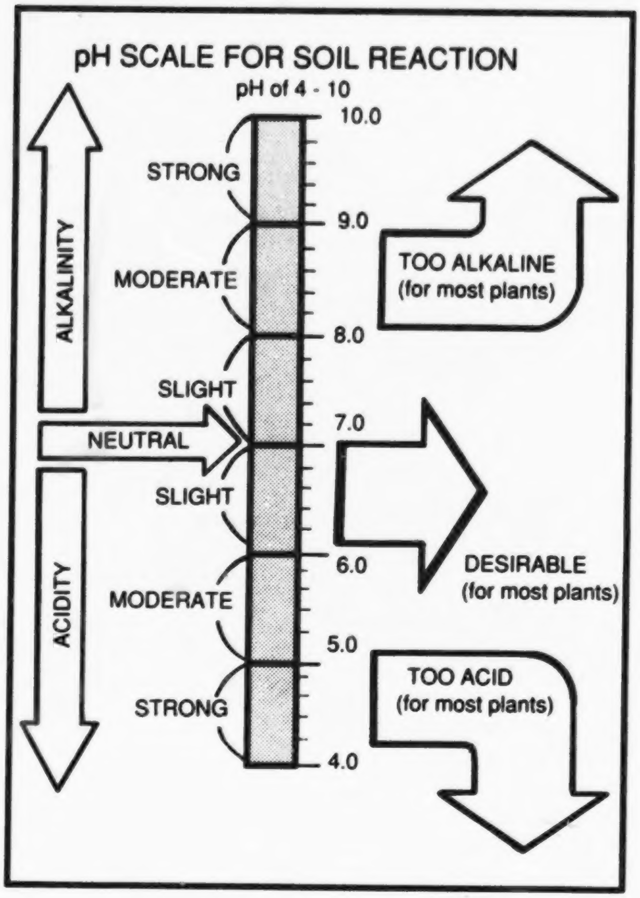

pH SCALE FOR SOIL REACTION
pH of 4 - 10
10.0
9.0
8.0
7.0
6.0
5.0
4.0
ALKALINITY
NEUTRAL
ACIDITY
STRONG
MODERATE
SLIGHT
SLIGHT
MODERATE
STRONG
TOO ALKALINE
(for most plants)
DESIRABLE
(for most plants)
TOO ACID
(for most plants)

Illustration reprinted with permission of Texas A & M, 1985.

**OBJECTIVE 9**

**Distinguish between methods of adjusting soil pH.**
(Supplement 1, Assignment Sheet 2, Job Sheet 1, Assignment Sheet 3)

**NOTE:** If the pH value is too low, plants cannot absorb aluminum and iron from the soil. If the pH value is too high, nitrogen and phosphorus are not available to the plant.

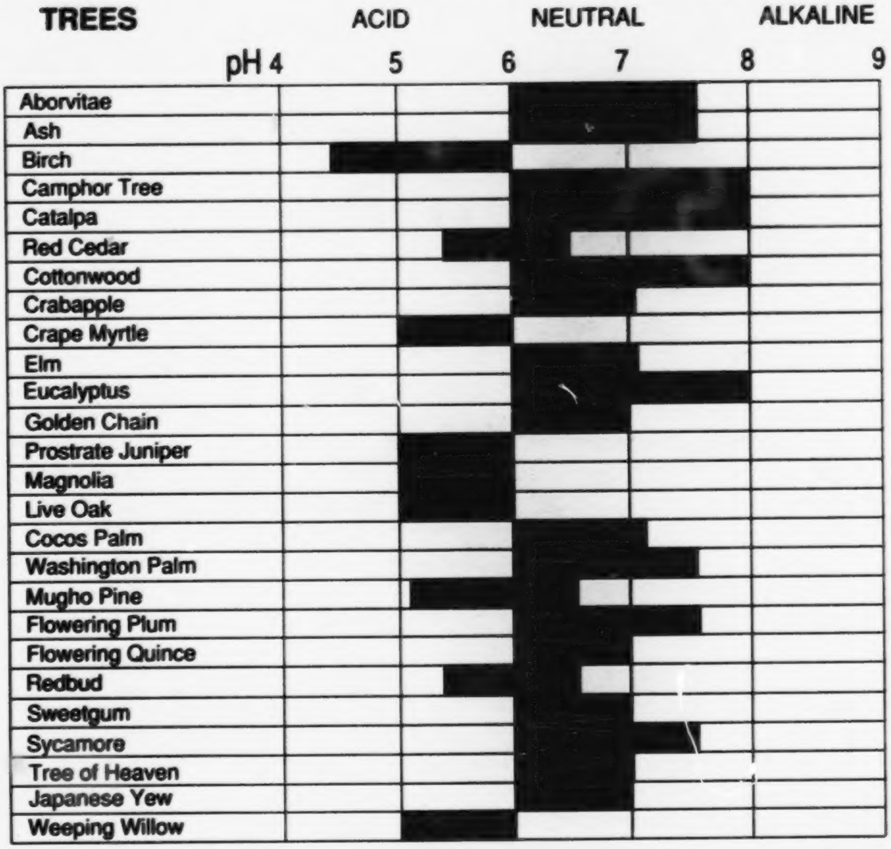
- To lower pH if the soil is too alkaline, add
  - Sulfur

    OR
  - Aluminum sulfate
- To raise pH if the soil is too acid, add
  - Gypsum

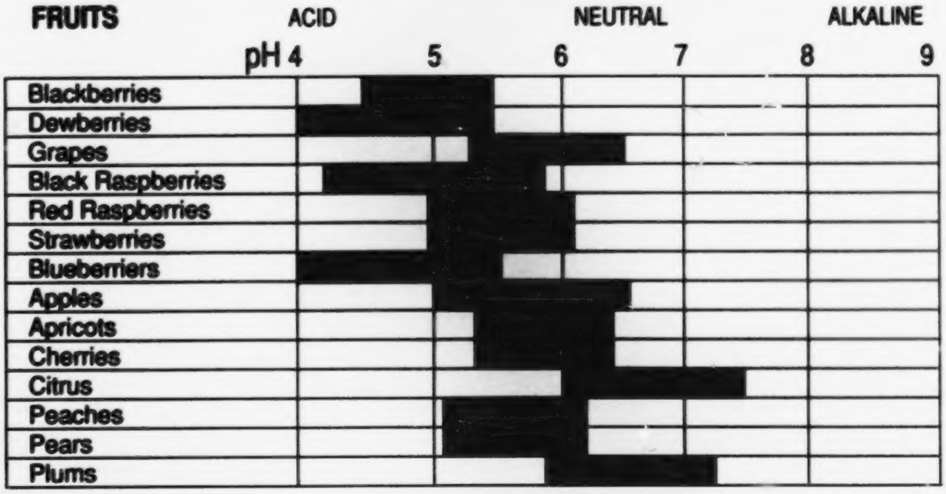
    OR
  - Agricultural lime

## BEST SOIL pH RANGES FOR POPULAR FRUITS, VEGETABLES AND HERBS, SHRUBS, FLOWERS, AND TREES

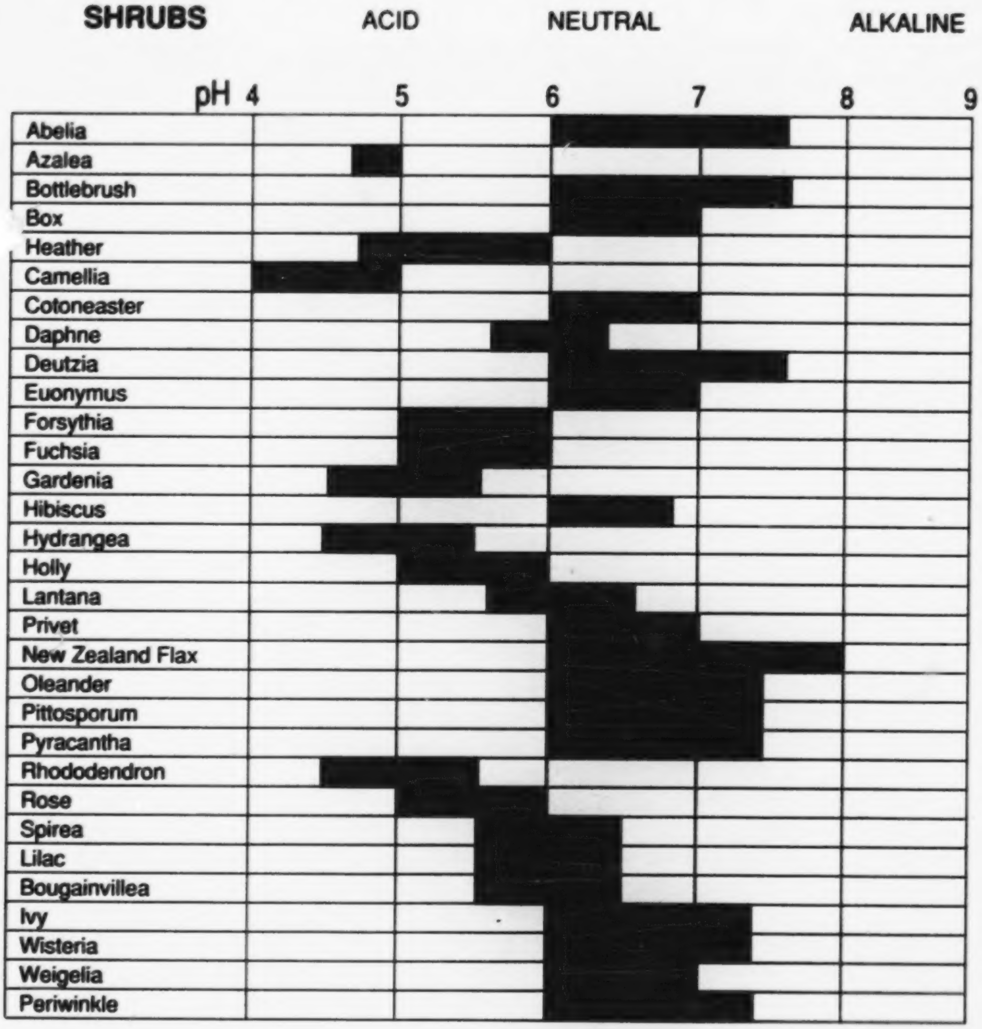
**TREES**

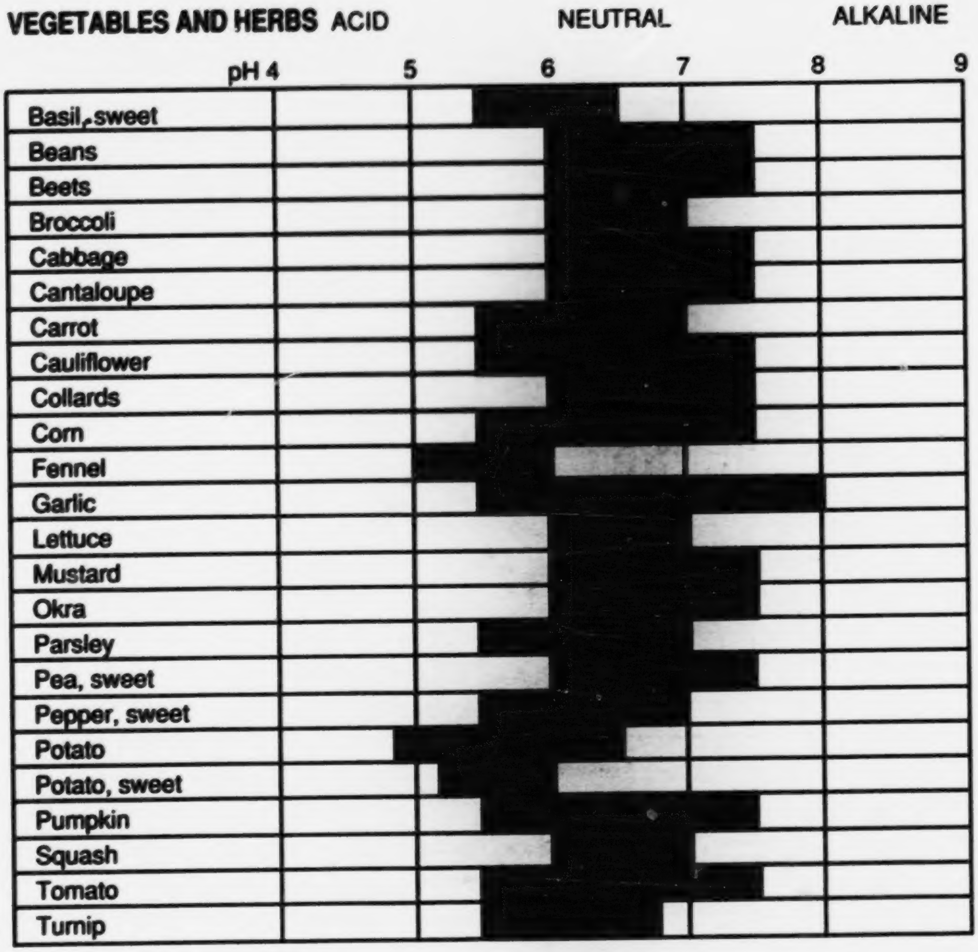


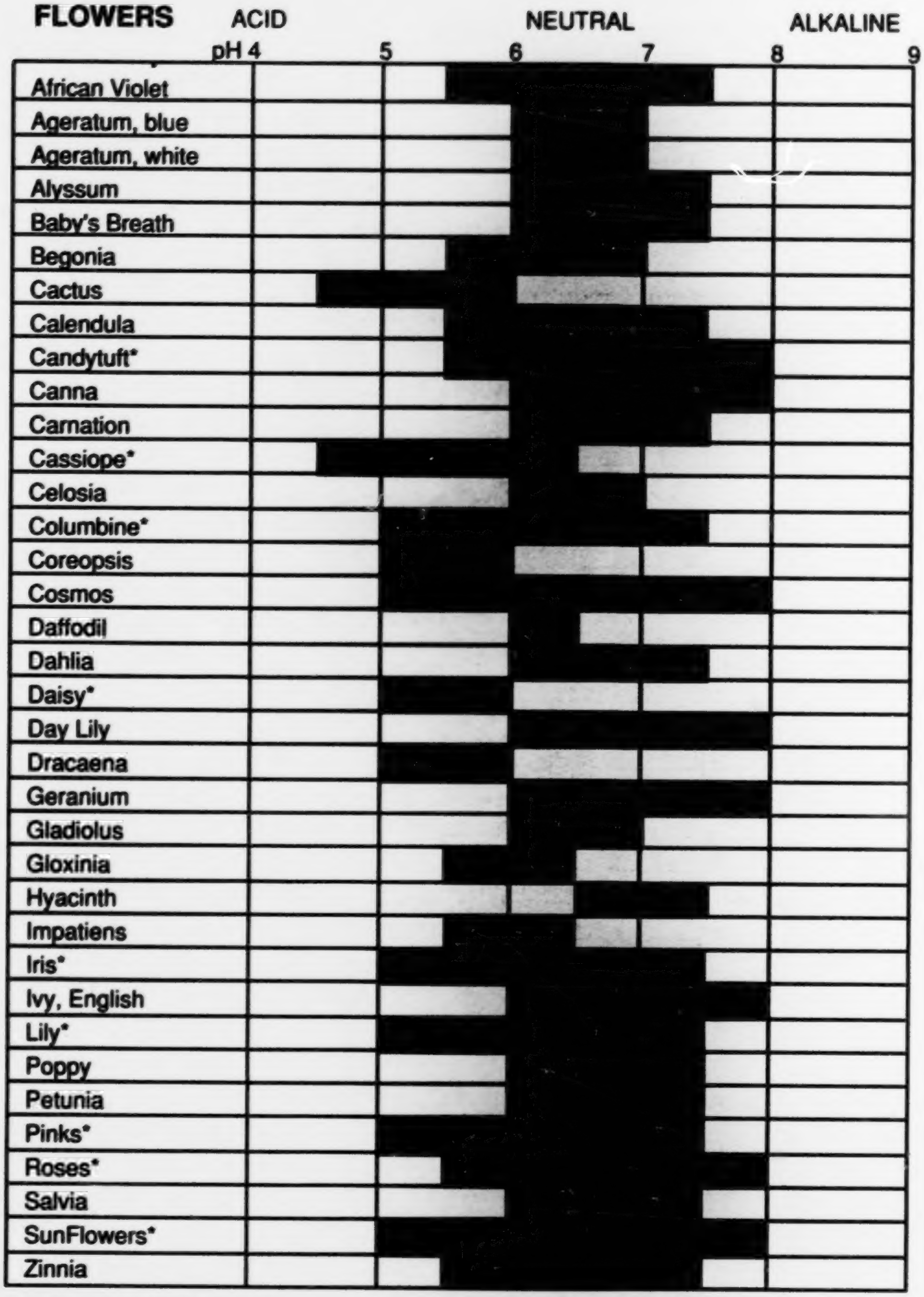
**FRUITS**



## SHRUBS


ACID
NEUTRAL
ALKALINE
pH
4
5
6
7
8
9
Abelia
Azalea
Bottlebrush
Box
Heather
Camellia
Cotoneaster
Daphne
Deutzia
Euonymus
Forsythia
Fuchsia
Gardenia
Hibiscus
Hydrangea
Holly
Lantana
Privet
New Zealand Flax
Oleander
Pittosporum
Pyracantha
Rhododendron
Rose
Spirea
Lilac
Bougainvillea
Ivy
Wisteria
Weigelia
Periwinkle


VEGETABLES AND HERBS
ACID
NEUTRAL
ALKALINE
pH 4
5
6
7
8
9
Basil, sweet
Beans
Beets
Broccoli
Cabbage
Cantaloupe
Carrot
Cauliflower
Collards
Corn
Fennel
Garlic
Lettuce
Mustard
Okra
Parsley
Pea, sweet
Pepper, sweet
Potato
Potato, sweet
Pumpkin
Squash
Tomato
Turnip



*Various species have different requirements within this range. Check a full pH table before planting.

**ASSIGNMENT SHEET 1**

# ELEMENTARY STUDY OF SOILS

# XII

NAME ______________________________ SCORE _______

**OBJECTIVE 10**

**Calculate soil type.**

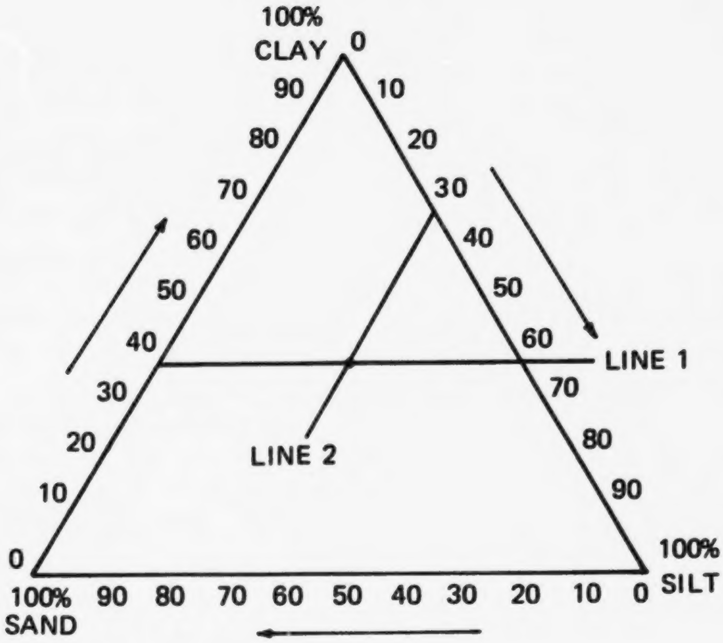
**INTRODUCTION**

The textural triangle is an easy way to determine soil type when you know the percentages of sand, silt and clay in your soil. The triangle helps you understand how the different soil types are related.

**DIRECTIONS**

On the following page is a simplified example of the textural table (Figure 5). Follow the step-by-step procedure to calculate soil type. Then turn to the complete triangle (Figure 6). Use the percentages listed at the bottom to determine soil type.

FIGURE 5

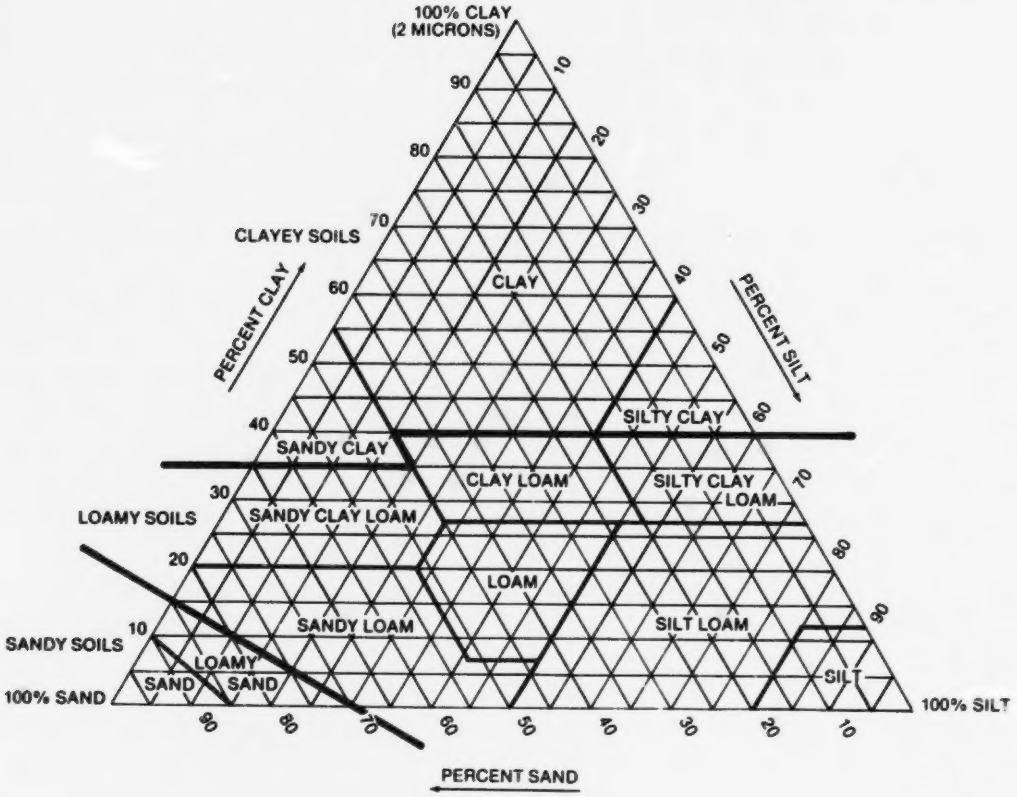

100%
CLAY
0
90
10
80
20
70
30
60
40
50
50
40
60
LINE 1
30
70
20
LINE 2
80
10
90
0
100%
SILT
100%
SAND
90
80
70
60
50
40
30
20
10
0

EXAMPLE: Soil type - 35% clay, 30% silt, 35% sand

1. Plot the silt and clay points on the triangle
2. Using the clay point, draw a line into the triangle parallel to the sand line (see Line 1).
3. Using the silt point, draw a line parallel to the clay line (See Line 2).
4. The point where these two lines intersect determines the soil type; in this example it is clay loam.

**FIGURE 6**

## Guide for Textural Classification


100% CLAY
(2 MICRONS)
90
80
70
60
50
40
30
20
10
CLAYEY SOILS
PERCENT CLAY
LOAMY SOILS
SANDY SOILS
100% SAND
PERCENT SILT
10
20
30
40
50
60
70
80
90
100% SILT
PERCENT SAND
90
80
70
60
50
40
30
20
10
CLAY
SILTY CLAY
SANDY CLAY
CLAY LOAM
SILTY CLAY LOAM
SANDY CLAY LOAM
LOAM
SANDY LOAM
SILT LOAM
SILT
LOAMY SAND
SAND

Source: U.S. Department of Agriculture, Soil Conservation Service.

|  | % Clay | % Silt | % Sand | Soil Type |
|---|---|---|---|---|
| 1. | 60 | 30 | 10 | 1 ____________ |
| 2. | 40 | 10 | 50 | 2 ____________ |
| 3. | 20 | 20 | 60 | 3 ____________ |
| 4. | 50 | 30 | 20 | 4 ____________ |
| 5. | 10 | 30 | 60 | 5. ____________ |
| 6. | 30 | 45 | 25 | 6. ____________ |
| 7. | 75 | 10 | 15 | 7. ____________ |
| 8. | 30 | 40 | 30 | 8 ____________ |
| 9. | 30 | 45 | 25 | 9 ____________ |
| 10. | 20 | 35 | 45 | 10 ____________ |

**ASSIGNMENT SHEET 2**

## ELEMENTARY STUDY OF SOILS

NAME ______________________________ SCORE ______

**OBJECTIVE 11** **Recommend treatments for pH problems in soils.**

**INTRODUCTION** A pH level that is too high or too low can stunt or kill a plant. It is important that you know what pH values mean and what steps to take to remedy a pH problem.

**DIRECTIONS** Answer these questions on how to correct soil pH.

1. Your plant's soil has a pH of 8.2. A pH of 7.5 is needed to plant cottonwoods. Correct the problem by adding

   ______________________________

2. Your plant's soil has a pH of 4.0. A pH of 6.5 is needed to grow hibiscus. Correct the problem by adding

   ______________________________

3. Your plant's soil is too acid. Correct the problem by adding

   ______________________________

4. Your plant's soil is too alkaline. Correct the problem by adding

   ______________________________

5. Your plant's soil is neutral. What is the pH?

   ______________________________

6. The pH in your experimental bed measures 20' x 20'. The pH is 5.5. You want to transplant wisteria into the bed. Your bag of agricultural lime has an application rate of 5 pounds per 100 square feet to raise the pH by .5.

   a. Use the pH table in the Supplement 1 to find the pH of wisteria.

      pH = ______________________________

b. How much you can increase the pH and stay inside the proper range for wisteria?__________________________

c. How much area do you have to cover?________________

d. How much lime will you use to bring the pH to the bottom of the wisteria's range?____________________________

e. How much lime will you use to bring the pH to the top of the wisteria's range?______________________________

7. Refer to the pH charts in your Supplement 1 and answer these questions.

   a. What is the most common range for fruits?

   ________________________________________________

b. What is the most common range for trees?

c. What is the most common range for shrubs?

d. What is the most common range for flowers?

e. What is the most common range for vegetables?

8. List the horticultural items that particularly interest you and list their pH values.

## ASSIGNMENT SHEET 3

## ELEMENTARY STUDY OF SOILS XII

NAME ______________________________ SCORE _______

**OBJECTIVE 12**

**Determine pH requirements of greenhouse and nursery plants.**

**NOTE:** You must complete Job Sheet 1 before completing this Assignment Sheet.

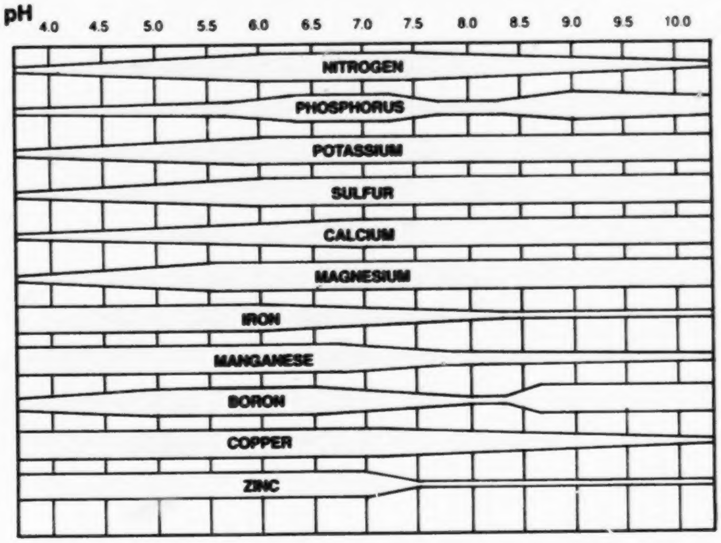
**INTRODUCTION**

In olden days farmers tested the soil by tasting it. If it tasted sour, it was acid, and they called it "sour soil." If the soil tasted sweet, it was alkaline, and they called it "sweet soil." If the soil tasted bitter, it was too alkaline and would not support plant growth. Today, some people still refer to the pH level as having sour or sweet soil.

The pH of the soil enables plants to use fertilizer and nutrients. When the pH is within the proper range, nutrients in the soil are unlocked and available to the plant. If the pH is too low or too high, the plant can't absorb the nutrients, even from fertilizer. If the soil pH is wrong for the plant, fertilizer applications are wasted. (Figure 7)

FIGURE 7

## Availability Scale



Proper pH means that the essential nutrients are available to the plant and that the plant has the vitality to produce, resist disease, and multiply.

**DIRECTIONS**

You are planning to transplant all the outdoor plants in your class, greenhouse or nursery into one of the following gardens: (1) the horticulture garden, (2) a local garden in town, or (3) around the school building. Record your information on the chart.

1. Using the pH tables in the handout or other sources in your classroom, determine the pH range for each outdoor plant variety in your class, greenhouse or nursery.

2. Then, using litmus paper or a pH meter, test the soil in the school garden, a local garden or around the school building and determine the pH level.

   **NOTE:** If you use a pH meter, be sure to thoroughly clean the tines before each test.

3. Determine

   (a) if the pH is in the correct range for each plant,

(b) whether the soil pH should be raised or lowered, and

(c) what product you would add to the soil to correct the pH.

## pH REQUIREMENTS FOR GREENHOUSE AND NURSERY PLANTS

____________pH level of your soil

| Plant Name | pH Range | OK | Raise pH | Lower pH | Add to Soil |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**ASSIGNMENT ANSWERS**

## ELEMENTARY STUDY OF SOILS

## XII

**ASSIGNMENT SHEET 1**

1. Clay
2. Sandy clay
3. Loam
4. Clay
5. Sandy loam
6. Clay loam
7. Clay
8. Clay loam
9. Silt loam
10. Loam

**ASSIGNMENT SHEET 2**

1. Sulphur, aluminum sulfate
2. Agricultural lime, gypsum
3. Agricultural lime, gypsum
4. Sulphur, aluminum sulfate
5. 7.0
6. a. 6.0-7.5
    b. .5-2.0
    c. 400 sq. ft.
    d. 20#
    e. 80#

7. a. 5.5-6.0
   b. 6.0-7.5
   c. 6.0-7.5
   d. 6.0-7.5
   e. 6.0-7.5

8. Praise student's effort with a personal note.

**ASSIGNMENT SHEET 3**

Check pH reading of soil.

Check chart for:

(1) correct pH ranges of plants

(2) whether soil pH should be raised or lowered

(3) if raised, add agricultural lime or gypsum if lowered, add sulphur or aluminum sulphate

**OBJECTIVE 13**

**Demonstrate the ability to test soil pH value with litmus paper.**

**NOTE: Litmus paper is an absorbent paper treated with a purple coloring. The dye is made from lichens. Litmus paper is used to test for acids and alkalines, also called "base". The litmus paper turns blue in bases (alkalines) and red in acids. Remember blue for base and red for burning acid.**

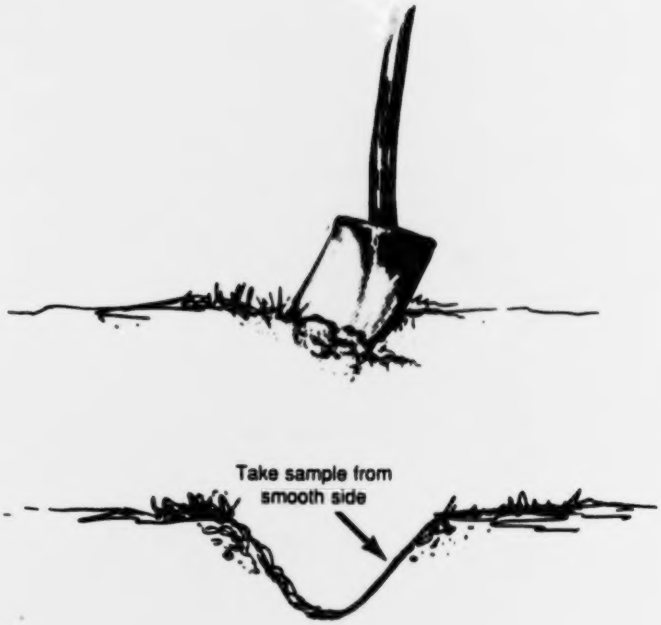
**TOOLS AND MATERIALS**

- Shovel
- Spoon or trowel
- Clean container such as a clean jar, plastic bag, or envelope
- Cleaning cloth
- Spoon, fork, or mixing stick
- Filters (coffee filters are acceptable)
- Funnel or coffee filter holder
- Clean bowl
- Litmus paper
- pH color chart
- Liquid measure, calibrated in ounces
- Water
- Paper and pen or pencil

**PROCEDURE**

1. Dig a hole at least 4 inches deep where the soil sample will be taken.
2. With the spoon or trowel, take a small amount of soil from the smooth side of the hole, 2 1/2 to 3 inches below the surface. (Figure 8)

FIGURE 8


Take sample from smooth side

3. Put the sample in the container.

4. Clean the spoon or trowel with the cloth.

5. Take samples from several points in the garden:

    a. Corners

    b. Center

    c. Places where the surface changes, such as high areas.

6. Mix soil thoroughly.

7. Place filter in holder and holder in the bowl.

    **NOTE:** Use two filters if using coffee filters.

8. Place approximately 1 tablespoonful of soil in the filter.

9. Pour 1 to 1 1/2 ounces of water over the soil and let it filter into bowl.

10. Dip litmus paper into water, watch color change.

11. Compare color of paper to pH values on chart.

    **NOTE:** Color may not match exactly. Look for the closest match.

12. Write down soil pH value.

**PRACTICAL TEST 1**

## ELEMENTARY STUDY OF SOILS

# XII

**JOB SHEET 1**

**Demonstrate the ability to test soil pH value with litmus paper.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Dug a hole at least 4 inches deep. | ____ | ____ |
| 2. With the spoon or trowel, took a small amount of soil from the smooth side of the hole, 2 1/2 to 3 inches below the surface. | ____ | ____ |
| 3. Put the sample in the container. | ____ | ____ |
| 4. Cleaned the spoon or trowel with the cloth. | ____ | ____ |
| 5. Took samples from several points in the garden: | | |
| a. Corners | ____ | ____ |
| b. Center | ____ | ____ |
| c. Places where the surface changes, such as high areas. | ____ | ____ |
| 6. Mixed soil thoroughly. | ____ | ____ |
| 7. Placed filter in holder and holder in the bowl. | ____ | ____ |
| 8. Placed approximately 1 tablespoonful of soil in the filter. | ____ | ____ |
| 9. Poured 1 to 1 1/2 ounces of water over the soil and let it filter into bowl. | ____ | ____ |

| The student: | YES | NO |
|---|---|---|
| 10. Dipped litmus paper into water, watched color change. | ______ | ______ |
| 11. Compared color of paper to pH values on chart. | ______ | ______ |
| 12. Wrote down soil pH value. | ______ | ______ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Gathered sample | 4 | 3 | 2 | 1 |
| Determined soil pH | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program, limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

# ELEMENTARY STUDY OF SOILS XII

NAME ______________________________ SCORE _______

**OBJECTIVE 1**

**Match terms associated with the elementary study of soils to their correct definitions.** Write the correct letters in the blanks.

___ 1. Soil containing sand, silt, clay, and organic matter

___ 2. General term for inorganic material in the soil

___ 3. Original rocky material before weathering has taken place

___ 4. Mosslike plants consisting of algae and fungi; grow in clumps on rocks and tree trunks

___ 5. Measure of acidity or alkalinity of soil

___ 6. Surface features of a region, including hills, valleys, rivers, lakes, mountains

___ 7. Plant and animal residues and remains

___ 8. Water moving downward carries nutrients away from plant roots

a. Bedrock

b. Curvature

c. Inorganic matter

d. Loam

e. Lichens

f. Minerals

g. Nutrients

h. Organic matter

i. Parent material

j. pH value

k. Topography

l. Leach

m. Topsoil

**OBJECTIVE 2**

**Select from the following list statements describing how soil is formed.** Write an "X" in the blank before each statement that describes how soil is formed. (Questions are continued on the following page.)

___ 1. Soil formation begins as rock that is broken into smaller particles by snow, ice, wind, and rain.

___ 2. This first breakdown is the parent material.

___ 3. Lower plant forms such as lichens, moss and fungi grow on the rock particles, then decompose, adding chemical compounds to the rock particles so that higher plant forms can grow.

____4. As plant and animal matter break down and decay they release pH values essential for soil formation.

____5. Soil is further broken down by different types of weathering that change the consistency, chemical makeup, moisture content, and general composition.

____6. Physical weathering is soil breakdown caused by heating and cooling, freezing and thawing, wind, and water. Other factors such as glaciers and earth movements grind larger rocks into smaller ones.

____7. Chemical weathering is the reaction and interaction of water, oxygen, carbon dioxide, and other substances that act on soil particles.

____8. Climate, meaning temperature and rainfall, affects the rate of chemical reaction.

____9. Topography affects the breakdown of larger particles through runoff and gravity; causes particles to move up or down slopes and relocates the parent material; and affects the amount of moisture in the soil through runoff and drainage.

___10. These factors combine to create soils with different particle structures and sizes, particle types, amounts of organic and inorganic content, layers of soil, and pH values.

**OBJECTIVE 3** **List composition ratios of an average soil particle.**

1. Mineral matter—________________
2. Water—_______________________
3. Air—_________________________
4. Organic matter—________________

**OBJECTIVE 4** **Describe soil texture.**

____________________________________________________

____________________________________________________

____________________________________________________

____________________________________________________

____________________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**OBJECTIVE 5**

**Distinguish between types of soil particles.** Write the correct names in the blanks: clay, loam, sand or silt.

1. __________ Good nutrient retention
2. __________ When wet, forms easily-crumbled ball
3. __________ When dry, feels mellow, somewhat gritty; clods are somewhat hard to break by hand
4. __________ When dry, feels smooth, soft and floury, shows fingerprints; makes hard-to-break clods
5. __________ Smallest soil particle; microscopic
6. __________ Drains quickly
7. __________ When wet, feels smooth, slick like butter, stains fingers
8. __________ Good drainage and good moisture retention
9. __________ Largest soil particle
10. __________ When dry, feels extreme pressure is needed to break clods by hand
11. __________ Very good nutrient retention
12. __________ May hold water and nutrients so tightly that they are unavailable for plants
13. __________ Smaller in size than sand
14. __________ Poor nutrient retention
15. __________ A balanced mixture; 50% solid matter and 50% space between solids
16. __________ Shrinks and expands dramatically as water varies, leaving soil cracked and cloddy

**OBJECTIVE 6**

**Explain how soil particle size affects the movement of water through soil.**

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**OBJECTIVE 7**

**Match types of soil water to their descriptions.** Write the correct letter in the blank.

____1. Water that moves down and away from the surface, not used by plants

____2. Water held by the soil and available to plants through their roots

____3. Water held so tightly in soil that it is unavailable to plants

a. Capillary

b. Surface

c. Gravitational

d. Hydroscopic

e. Hygroscopic

**OBJECTIVE 8**

**State pH values for soil types.**

1. __________Neutral soil

2. __________Acidic soil

3. __________Alkaline soil

**OBJECTIVE 9**

**Distinguish between methods of adjusting soil pH.** Write an "L" for methods used to lower pH and an "R" for methods used to raise pH.

____1. Add lime

____2. Add sulfur

____3. Add aluminum sulfate

____4. Add agricultural lime

| | | |
|---|---|---|
| **NOTICE** | **The following assignment sheets and job sheet are not a part of the written test. If these activities have not been completed, check with your instructor.** | |
| **OBJECTIVE 10** | **Calculate soil type.** | SCORE ______ |
| **OBJECTIVE 11** | **Recommend treatments for pH problems in soils.** | SCORE ______ |
| **OBJECTIVE 12** | **Determine pH requirements of greenhouse and nursery plants.** | SCORE ______ |
| **OBJECTIVE 13** | **Demonstrate the ability to test soil pH value with litmus paper.** | RATING ______ |

**OBJECTIVE 1**

1. d
2. f
3. i
4. e
5. j
6. k
7. h
8. l

**OBJECTIVE 2**

1, 2, 5, 6, 7, 8, 9, 10

**OBJECTIVE 3**

1. 45%
2. 25%
3. 25%
4. 5%

**OBJECTIVE 4**

Answer should include the following points:

- Soil texture refers to the size of the individual particles
- Particles are classed according to size: fine—clay, medium—silt, coarse—sand and gravel
- Soil is a mixture of sand, silt and clay in the surface layer. The percentage of each type of particle determines the soil's ability to drain and hold water.

**OBJECTIVE 5**

1. Silt
2. Sand
3. Loam
4. Silt
5. Clay
6. Sand
7. Silt
8. Loam
9. Sand
10. Clay
11. Clay
12. Clay
13. Silt
14. Sand
15. Loam
16. Clay

**OBJECTIVE 6**

Answer must include these points:

- Water retention depends on soil texture.
- The larger the particles, the faster water moves through them.
- As the water moves through the soil, it leaches nutrients that must be replaced by fertilizer.

**OBJECTIVE 7**

1. c
2. a
3. e

**OBJECTIVE 8**

1. 7
2. 0-7
3. 7-14

**OBJECTIVE 9**

1. R
2. L
3. L
4. R

| | |
|---|---|
| **OBJECTIVE 10** | Refer to answers to Assignment Sheet 1. |
| **OBJECTIVE 11** | Refer to answers to Assignment Sheet 2. |
| **OBJECTIVE 12** | Refer to answers to Assignment Sheet 3. |
| **OBJECTIVE 13** | Refer to Practical Test for Job Sheet 1. |

**OBJECTIVE SHEET**

# INTRODUCTION TO FERTILIZERS

# XIII

**INTRODUCTION**

Nutrition is as important to plants as it is to humans and all life forms. Feeding seedlings and plants correctly is the single most important key to good plant growth and development and to a successful greenhouse or nursery operation. Whether you work in a small greenhouse and water by hand, or in a large production greenhouse equipped with computerized automatic irrigation systems, what you learn in this unit will help you succeed in knowing and using commercial fertilizers.

**UNIT OBJECTIVE**

After completing this unit, the student should know the types of fertilizers and how they are applied, plant nutritional requirements, be able to read and analyze the information on fertilizer bags and calculate how to mix injector fertilizer. The student will demonstrate these competencies by completing assignment sheets and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with fertilizers to their correct definitions.
2. Label components of complete fertilizer formula (Guaranteed analysis).
3. Distinguish values of essential plant food elements nitrogen, phosphorus, and potassium.
4. Match secondary elements necessary for growth and development to their descriptions.
5. Select from a list micronutrients required for plant growth and development.
6. Describe types of commercial fertilizers.
7. Match manual indoor and outdoor application methods to their correct descriptions.
8. State rules for storing fertilizer bags.
9. State regulations for handling fertilizers.

10. Select from a list information required on fertilizer bags.

11. Analyze information required on fertilizer bags. (Assignment Sheet 1)

12. Use fertilizer label and ppm to calculate amount of dry fertilizer to be added to an injector system tank. (Assignment Sheet 2)

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Order materials to supplement unit.
- Invite a greenhouse manager or supervisor to talk to the class about fertilizers. Invite a civil defense officer, cooperative extension agent, or safety counselor to discuss proper storage of fertilizers and hazardous materials.

  NOTE: Supply guest speakers with the Objective Sheet, Information Sheet and any other components you want them to cover.
- Obtain samples of different types of fertilizers: pellets, prills, granular, and types of dry fertilizer; complete and incomplete formulas.
- Call your local distributor or a fertilizer manufacturer and request sample labels.
- Use sample labels or make "flash cards" with fertilizer formulas to give students practice in recognizing and reading NPK percentages.
- Contact manufacturers and request Material Safety Data Sheets (MSDS) for the products used in your program.
- Arrange for a field trip to a local greenhouse or commercial producer and request a demonstration of fertilizer injectors and other fertilization methods not available to students in your facility.
- Obtain a copy of federal regulations that deal with storing and handling fertilizers.

**DELIVERY**

**Objectives 1 and 2**

- Discuss terms and definitions, support them with examples of fertilizer types, connect terms such as "organic fertilizer" to students' experience with home gardening, natural life-death cycles (refer to Unit 12, *Elementary Study of Soils* for a discussion of how organic matter builds soil), and organic fertilizers easily available in your area, such as cottonseed hulls.
- Use "flash cards" and an NPK Bee (like a spelling bee) to help students learn the nitrogen-phosphorus-potassium formula and tell whether the formula is a complete or incomplete fertilizer.

**Objective 3 through 5**

- Draw analogies between human nutritional needs and plant nutritional needs. For example, in humans phosphorus is concerned with producing energy, building strong bones and teeth, aids in absorption of other nutrients. Deficiency leads to lowered resistance to infection. Potassium is concerned with energy production, internal structure of body cells, protein synthesis, preserving the acid-alkali balance of the body in conjunction with phosphate, sodium, calcium and magnesium. Deficiency causes muscle weakness, low blood pressure, drowsiness and other symptoms of "slowing down." Health science or biology teachers may have this information.
- Assign each student the responsibility of finding out about one macronutrient and/or one micronutrient. Have them make oral reports to the class.
- Have students survey your plants or school-yard plants for examples of nutritional deficiency. Encourage them to handle deficient plants as well as look at them. Assign them to visit home gardens or examine house plants for symptoms and report their findings.
- Have students draw or trace and then color or paint examples of plants deficient in essential and secondary nutrients.

**Objectives 6 and 7**

- Demonstrate various types of fertilizers and their application methods.
- Take students to a commercial greenhouse or production greenhouse to learn about different fertilization methods.

- Let students discuss the ways they have applied fertilizer in their home gardens and to their house plants.

**Objectives 8 and 9**

- Explain the consequences when moisture gets into fertilizer bags. Let students calculate the loss in dollars if your supply were not properly stored.
- Have students scan the Federal Regulations and discuss ways in which your program and facilities comply with the regulations.
- Ask students to design additions to your program or facility that would allow complete compliance.
- Let students look at MSDSs on the fertilizers and chemicals in your facility.

**Objective 10**

- Use your own fertilizer bags as examples. Point out that instructions for handling and storing are a recent addition to regulated information.

## APPLICATION

**Objectives 11 and 12**

- Use Assignment Sheet 1 to let students analyze labels and synthesize the information, then apply their learning to matching fertilizers with plant problems.
- Bring in sample labels and let students practice reading them. Have a game such as "College Bowl" where panels compete to answer questions. Use "flash cards" of sample labels for students to name the uses of the fertilizer.
- Use Assignment Sheet 2 to sharpen label-reading skills, problem-solving and math skills, and to give students an idea of the range of fertilizer application rates. Work through the sample problem on the board. Encourage students to make the job easier by rounding off totals as they work.

## EVALUATION

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

**NOTE:** The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

**SUGGESTED RESOURCES**

**Publications**

- Peters® Fertilizers *Technical Manual*. Sample labels; includes a test of solubility, tables for injection ratios, and general discussions of various fertilizer formulas. Available from your greenhouse supplier or from R.W. R. Grace & Co., Iron Run Industrial Park, Fogelsville, PA 18051, telephone (215) 395-7105.

**UNIT REFERENCES**

- Ball, Vic, Ed. *Ball Red Book: Greenhouse Growing*, 14th ed. Reston, Virginia: Reston Publishing Co., Inc., 1985.
- Cook, R. L. *Soil Management for Conservation and Production*. New York: John Wiley & Sons, Inc., 1962.
- *Horticultural Occupations*, Catalog No. 31B, 2nd edition. College Station, Texas: Texas A & M University, Instructional Materials Service, 1985.
- Mervyn, Leonard. *Thorsons Complete Guide to Vitamins & Minerals*. Wellingborough, New York: Thorsons Publishing Group, 1986.
- Reiley, H. Edward & Carroll L. Shry, Jr., *Introductory Horticulture*, 3rd edition. Albany, N.Y.: Delmar, 1988.
- Richardson, William B., and Moore, Gary B., *Working in Horticulture*. New York: Gregg Division/McGraw-Hill Book Company, 1980.
- Rodale, J. I. *Encyclopedia of Organic Gardening*. Emmaus, Penn: Rodale Books, Inc., 1975.

## INFORMATION SHEET — INTRODUCTION TO FERTILIZERS — XIII

**OBJECTIVE 1** **Match terms associated with fertilizers to their correct definitions.**

- **Complete fertilizer**—Fertilizer containing percentages of nitrogen, phosphorus and potassium
- **Incomplete fertilizer**—Fertilizer containing percentages of only one or two of the three major nutrients (nitrogen, phosphorus and potassium)
- **$K_2O$**—Potassium in oxide form
- **$P_2O_5$**—Phosphorus in oxide form

  NOTE: Phosphorus does not exist outside of a compound. It is always expressed as $P_2O_5$.

- **NPK**—Common name for the nutrient group of nitrogen, phosphorus, potassium

  NOTE: NPK is *not* the chemical notation. It is a shorter way of saying "Nitrogen, phosphorus and potassium." The chemical notation is N, $P_2O_5$, and $K_2O$.

- **Water soluble**—Can be dissolved in water

  EXAMPLES: A solid substance such as salt or sugar becomes liquid when mixed with water. If a substance is not water soluble, it will remain solid and, like sand, will sink to the bottom; or like oil, will float on the top.

- **Macronutrient**—Nutrient needed in large quantities for good plant growth

  EXAMPLES: C (Carbon), H (Hydrogen), O (Oxygen), N (Nitrogen), S (Sulfur), Ca (Calcium), Mg (Magnesium)

- **Micronutrient**—Nutrient needed in small quantities for good plant growth

  EXAMPLES: Fe (Iron), B (Boron), Zn (Zinc)

- **Foliar fertilizer**—Nutrients are sprayed onto and absorbed through the leaves; especially effective in feeding plants micronutrients

- **Organic fertilizer**—Naturally-occurring fertilizer; usually animal or plant matter, also some minerals, and some human byproducts

  EXAMPLES: Bone meal, blood meal, manure, compost, wood chips, peanut shells, cottonseed meal, peat moss, greensand, rock phosphate, gypsum, wood ashes, incinerator ashes, basic slag

- **Inorganic fertilizer**—Fertilizer manufactured with chemicals

  EXAMPLES: Osmocote®, 10-20-10, ammonium nitrate, sodium nitrate, potassium nitrate, superphosphate, mono-calcium phosphate

- **ppm**—Parts per million

**OBJECTIVE 2** **Label components of complete fertilizer formula (Guaranteed analysis).**

NOTE: Complete fertilizers are used on a regular basis in greenhouse operations and are generally applied through the watering system.

EXAMPLE: 10-20-10

| | | | | | |
|---|---|---|---|---|---|
| 10 | - | 20 | - | 10 | = 40% PLANT FOOD |
| Nitrogen | | Phosphorus (expressed as $P_2O_5$) | | Potassium (expressed as $K_2O$) | |

- First number is percent nitrogen (N)
- Second number is percent phosphorus ($P_2O_5$)
- Third number is percent potassium ($K_2O$)
- Sum of numbers equals percent plant food

  NOTE: The remaining 60% of material is inert ingredients not contributing to nutritional value. Inert matter is called filler or carrier. A unit of plant food is equal to 20 lbs, or 1% of a ton. The fertilizer formula tells how many units of each element in a ton.

**OBJECTIVE 3**

**Distinguish values of essential plant food elements nitrogen, phosphorus, and potassium.**

NOTE: These nutrients can be added or withheld to produce increased or decreased growth of specific parts of the plant. To withhold potassium, for example, decreases seed yield and germination rate.

- **Nitrogen** (N)—Produces leaf growth and dark green leaves. Nitrogen deficiency causes small leaves, pale flowers and pale or yellow leaves and stunted growth, particularly short stems. Excess nitrogen delays flowering, causes stems to grow too long, reduces quality of fruits, and lowers resistance to disease

- **Phosphorus** ($P_2O_5$)—Produces strong root systems, brighter and more beautiful flowers; and rapid growth. Phosphorus deficiency causes small, thin plants with purplish foliage, sterile seeds, and plants are slow to mature

  NOTE: Phosphorus is also thought to increase seed yield and fruit development, improve resistance to diseases and winter kill and to increase the vitamin content of plants.

- **Potassium** ($K_2O$)—Produces and matures the seed. Potassium is essential for the production of protein and for all cell division and growth. It is responsible for the strength of the plant. It carries carbohydrates through the plant system, forming strong stems and making the plant resistant to diseases. A deficiency creates slow-growing, stunted plants with browning leaves and stunted fruits; plant cells grow longer instead of dividing

  NOTE: Potassium is also thought to improve the keeping quality of fruit, aid plants in producing starches, sugar and oils, decrease water requirement, increase disease resistance, reduce winter kill, promote fruit color, help plants use nitrogen, balance the effect of excess nitrogen or calcium, reduce boron requirement.

**OBJECTIVE 4**

**Match secondary elements necessary for growth and development to their correct descriptions.**

NOTE: Secondary elements are needed for good plant development. They are needed in smaller amounts than the essential nutrients and in greater amounts than the micronutrients. Specific fertilizers are available to correct deficiencies.

- **Calcium**—Promotes root formation and affects how the plant uses nutrients. Deficiency causes terminal buds to die at the tips and causes leaves to die around the edges

- **Magnesium**—Affects intake of plant nutrients; necessary for the formation of fats. Deficiency causes leaf veins to turn yellow and spotted. Stems grow tender and weak

- **Sulfur**—Promotes root growth. Deficiency causes young leaves to turn light green; stalks become long and slender

**OBJECTIVE 5**

**Select from a list micronutrients required for plant growth and development.**

NOTE: Micronutrients are essential for growth in plants just as they are in humans. Plants need only very small quantities, but if they are not available, the plants can't absorb and use the other available nutrients and cannot complete their biological functions. Micronutrients are usually applied as a complete micronutrient complex (as people would use B-Complex vitamins), but can be applied individually. They are available as granular fertilizer and in *fritted* form, which means elements are released slowly into the soil or potting medium. Micronutrients are also called "trace elements."

- Zinc
- Molybdenum
- Copper
- Iron
- Manganese
- Boron

**OBJECTIVE 6**

**Describe types of commercial fertilizers.**

NOTE: Liquid fertilizers are not listed here because they are not used in horticulture operations. They are used in home applications and in hydroponics gardening. Hydroponics is a growing method in which no soil is used. Plants are suspended on racks and roots are immersed in or misted with nutrient-rich water.

- **Granular**—Small pelleted form of dry fertilizer; to be dissolved in water or foliar spray

EXAMPLES: MagAmp and Choice 10-10-10

- **Timed-release**—Fertilizer designed for release over an extended period; available in quick, slow, and mid-release types; may be large pellets or prills (dry fertilizer core with water-soluble sulfur or plastic coating); is worked into soil, applied on top of soil, buried or dissolved in water; used in containers and outside plants

  EXAMPLES: Osmocote®, Plantabbs, Spikes

- **Water soluble**—Dry fertilizer is mixed with water and used in greenhouses; applied through injector systems or sprayers

  EXAMPLES: Peters®, Miller's Booster, Nulife Soluble Plant Food

**OBJECTIVE 7**

**Match manual indoor and outdoor application methods to their correct descriptions.**

- **Water hose and water breakers**—Nozzles divide water into small droplets for general watering, into smaller droplets for watering seedlings, and into tiny droplets for misting. A wand attachment is used to water hard-to-reach plants such as hanging baskets and outside benches

- **Hose-end sprayers**—Fertilizer is mixed with water in a jar attached to the hose. Water-soluble fertilizer is applied as plants are hand watered. Useful in greenhouse, garden and lawn applications

- **Fertilizer injectors**—Add water-soluble fertilizers to the main water line. Portable units allow specific fertilizer applications to specific greenhouse areas or to specific crops in the greenhouse

- **Incorporated**—Complete fertilizers and plant-specific nutrients and micronutrients are mixed into potting soil for transplanted seedlings and repotted plants. Timed-release fertilizers incorporated into transplanted seedling and repotting mix provide nutrients for 3-4 months

- **Buried in soil**—Pills, capsules or spikes release nutrients to the roots; used in individual pots, for trees and shrubs, for large vegetables such as tomato plants, and in flower beds

- **Top dressing**—Solid or spray fertilizer is hand-worked into large pots, around the base of individual plants or into garden soil

- **Hand-watering devices**—Dry fertilizer is mixed with water and applied with (1) a mister for foliar fertilizer, (2) a long-spout can for hanging plants or potted plants, or (3) a larger can for trees, shrubs, flowers and vegetables

- **Pressure sprayer**—Power-operated or hand-pumped unit applies liquid or dry fertilizer mixed with water over large areas such as lawns, vegetable or flower gardens

**OBJECTIVE 8**

**State rules for storing fertilizer bags.**

**NOTE:** Fertilizer must be kept dry at all times. Moisture from condensation will seep into bags from concrete or other surfaces.

- Store in a dry area

- Store away from walls

- Store away from concrete floors; construct a wood rack to raise bags

- Keep bags sealed

**OBJECTIVE 9**

**State regulations for handling fertilizers.**

- In schools, fertilizers and all chemicals must be kept in a locked room and the location must be on file with the fire department

- Store high nitrogen-content fertilizers in a separate area from complete fertilizers

  **NOTE:** High nitrogen-content fertilizers can explode. High nitrogen-content fertilizers should not be stored for any length of time. Storage instructions are listed on the bag and must be followed.

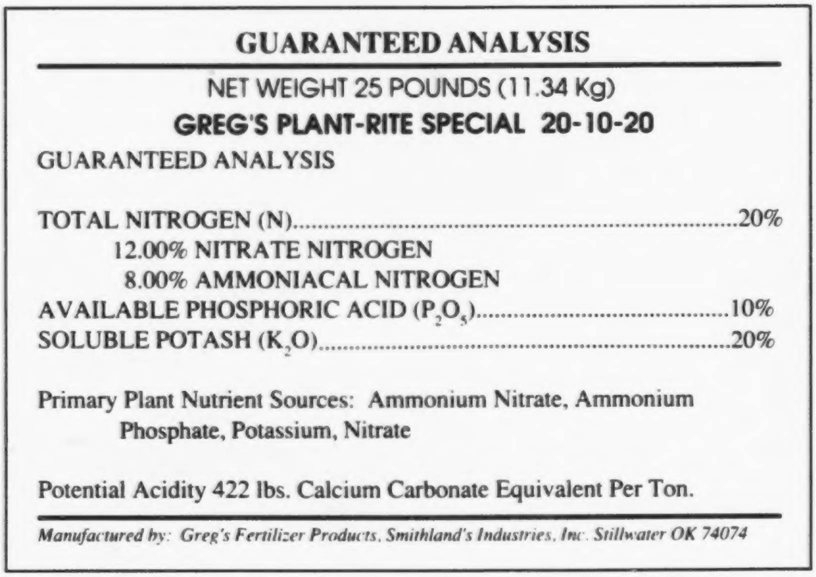
- Fertilizers containing herbicides are considered hazardous materials and must be stored in a locked room

  **NOTE:** Fertilizers with herbicides are controlled under hazardous materials regulations by state and federal governments. Such fertilizers must be stored and handled as a herbicide and considered poisonous.

**OBJECTIVE 10** **Select from a list information required on fertilizer bags.**

**NOTE:** The sample in Figure 1 is a "sample label" containing the guaranteed analysis and all required information except storing and handling instructions. (Figure 2).

FIGURE 1



**GUARANTEED ANALYSIS**

NET WEIGHT 25 POUNDS (11.34 Kg)

**GREG'S PLANT-RITE SPECIAL 20-10-20**

GUARANTEED ANALYSIS

TOTAL NITROGEN (N)........................................20%
- 12.00% NITRATE NITROGEN
- 8.00% AMMONIACAL NITROGEN

AVAILABLE PHOSPHORIC ACID ($P_2O_5$)........................................10%
SOLUBLE POTASH ($K_2O$)........................................20%

Primary Plant Nutrient Sources: Ammonium Nitrate, Ammonium Phosphate, Potassium, Nitrate

Potential Acidity 422 lbs. Calcium Carbonate Equivalent Per Ton.

*Manufactured by: Greg's Fertilizer Products, Smithland's Industries, Inc. Stillwater OK 74074*

- Name of fertilizer

  EXAMPLES: Brand name and/or chemical compound such as ammonium nitrate, urea, ammonium phosphate, potassium nitrate, fritted potash, nitric phosphate, calcium cyanamid, etc.

  **NOTE:** Type of fertilizer is generally listed: pelleted, prill, granular, etc.

- Guaranteed analysis lists all nutrients by name and chemical symbol and lists percentages of each

- Name and address of manufacturer

  **NOTE:** Manufacturer is obliged by law to provide Material Safety Data Sheets (MSDS) on request. The MSDS lists cautions, hazards, handling and storing requirements

- Instructions for storing and handling

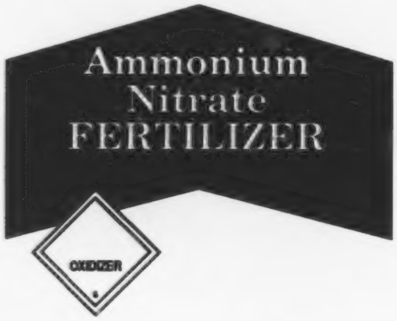
- Net weight

- Hazardous warning on potentially dangerous fertilizers (Figure 2)

  EXAMPLES: Hazardous symbols are provided on all high-nitrogen-content fertilizers.

  **NOTE:** "Oxidizer" means the fertilizer can explode. Safety procedures for storage, application, bag disposal and fires are also listed on the bag. The "Oxidizer" emblem is bright yellow.

  FIGURE 2



## ASSIGNMENT SHEET 1

## INTRODUCTION TO FERTILIZERS

## XIII

NAME ______________________ SCORE ______

**OBJECTIVE 11** **Analyze information required on fertilizer bags.**

**INTRODUCTION**

Chemical (inorganic) fertilizers are available to meet a wide range of nutritional needs. Complete fertilizers provide nitrogen, phosphorus and potassium in varying percentages. 10-20-10 and 20-10-20 are commonly used in greenhouse operations. Other examples are 14-4-6, 7-7-7, 12-6-6, and 20-20-20.

Incomplete fertilizers with a single nutrient list the NPK elements in the same order, using a zero when one element is not present.

EXAMPLES: Urea (Nitrogen) 46-0-0; Superphosphate 0-20-0; Potassium chloride 0-0-50

Combinations of elements are available for general fertilizing and for various applications identified by leaf analysis or soil analysis.

EXAMPLES: **General fertilizing**

Eco Grow 10-8-14
Miller's Booster 5-10-14
Agro Fish 'n Six 14-6-8

**Special applications**

Ammonium Nitrate 34-0-0
Mono-Potassium Phosphate 0-52-34
Potassium Nitrate 13-0-44

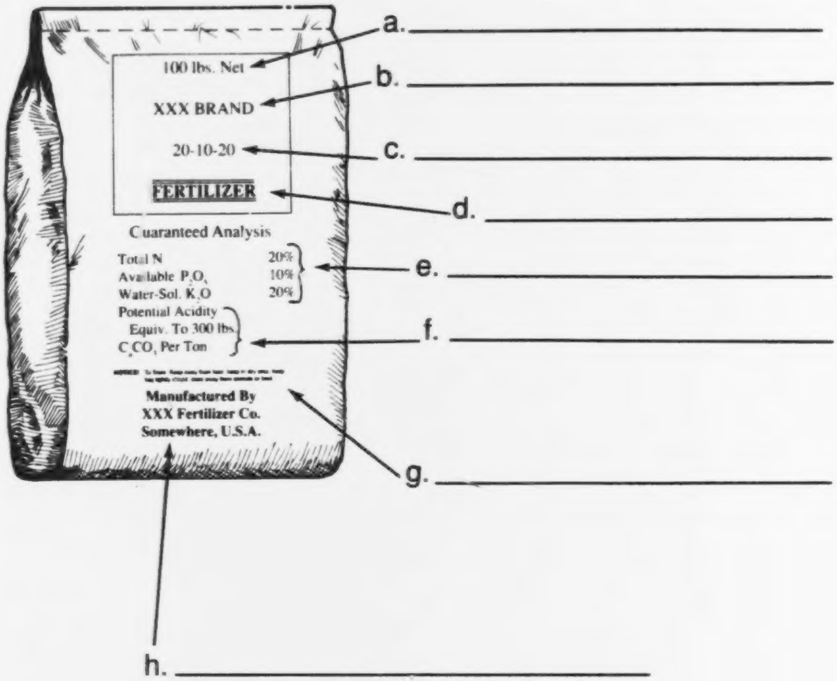
As you learn more about your greenhouse or nursery stock, you'll learn which plants have specific nutritional needs in order to produce lush foliage and quality flowers and fruits. You'll also learn to recognize and correct nutritional deficiencies. You will have to read a label and the fertilizer formula correctly and easily in order to do these tasks well.

Below is a fertilizer label. Follow the directions and answer questions about analyzing the label information.

**DIRECTIONS**

1. On the sample label below items of information are numbered. Select the items that are required by law. Identify that item and then describe what each represents on the next page.

FIGURE 3


100 lbs. Net
XXX BRAND
20-10-20
FERTILIZER
Guaranteed Analysis
Total N 20%
Available P2O5 10%
Water-Sol. K2O 20%
Potential Acidity Equiv. To 300 lbs. CaCO3 Per Ton
Manufactured By
XXX Fertilizer Co.
Somewhere, U.S.A.
a.
b.
c.
d.
e.
f.
g.
h.

2. In this 100# bag, what percent of the 100 pounds is:

   a. Phosphorus

   b. Nitrogen

   c. Potassium

   d. What is the percentage of plant food?

   e. What is the percentage of filler?

3. Refer to Objective 3 in the Information Sheet and determine which of these fertilizers would be the best choice to solve the problems listed below. Write the correct letter in the blank. Answers may be used more than once.

___ 1. A tomato plant is growing considerably more slowly than it should. The leaves are brown, the stalk is shorter than other tomatoes from the same seed bed. Tomatoes are small and deformed

___ 2. Leaves are pale and small, stems are short

___ 3. Plants are small and thin with purple spots

___ 4. The stems are too long, several plants have powdery mildew

___ 5. Plants look very healthy, growth rate is good, flowers are full in color and size, leaves are deep green

___ 6. Plants have dark, green leaves and flowers are average in color and size, but all the plants in the batch seem to be growing slowly and maturing slowly

a. 10-20-10

b. 0-0-20

c. 34-0-0

d. 0-20-0

e. 34-0-18

f. 10-30-20

g. 20-20-20

h. 20-0-20

**ASSIGNMENT SHEET 2**

# INTRODUCTION TO FERTILIZERS

# XIII

NAME ______________________________ SCORE ________

**OBJECTIVE 12**

**Use fertilizer label and ppm to calculate amount of dry fertilizer to be added to an injector system tank.**

**INTRODUCTION**

Fertilizer application in greenhouse and nursery operations requires special knowledge. Each type of fertilizer has its own application rates and requirements and each method of fertilizing has its own rates and requirements.

To fertilize with injectors, you'll have to mix ounces of dry fertilizer with gallons of water to make a concentrated solution. The concentrate is taken up into the watering system, measured in ppm, "parts per million." The injector can be set to use specific fertilizer ratios.

EXAMPLE: 1:300 mixed 1 ppm fertilizer to 300 ppm water

To calculate how much fertilizer to mix with water, we use a mathematical formula. This formula is based on the percent of active ingredient that you want to fertilize with, usually nitrogen. That information is on the fertilizer label.

The formula is easy to learn and remember:

$$\frac{1.33 \text{ x ppm}}{\text{\% of active ingredient}} = \text{oz of dry product per 100 gals of water}$$

EXAMPLE: Calculating for nitrogen in 20-10-20 fertilizer to be mixed at 320 ppm

$$\frac{1.33 \text{ x } 320}{20} = \frac{(1.33 \text{ x } 320)}{20} = \frac{425.60}{20} = 21.28 \text{ oz. per 100 gal}$$

**NOTE:** The percentage divided into the top number is a whole number and not a decimal.

If your water tank holds 50 gals, divide your answer by 2 because 50 gal is 1/2 of 100 gal. If your tank holds 25 gals, divide your answer by 4 because 25 is 1/4 of 100 gal. If your water tank holds 20 gal, you would divide your answer by______

Solve the problems on the back of this page.

**DIRECTIONS**

Use the formula $\frac{1.33 \times \text{ppm}}{\text{\% of active ingredient}} = \text{oz/100 gal}$

and calculate the amount of dry fertilizer to be used. Show your work. Answers and actual amounts of fertilizer can be rounded off if the amount is close.

EXAMPLE: 19.95 = round off to 20; 15.9 = round off to 16

1. Calculate the amount of nitrogen in 10-20-10 fertilizer to be mixed in a 50 gal tank at 200 ppm.

   Answer__________ oz

2. Calculate the amount of potassium in a 20-10-20 fertilizer to be mixed in a 25 gal tank at 300 ppm.

   Answer__________ oz

3. The mums in your greenhouse take 230 ppm of nitrogen and potassium each watering. You'll use 20-10-20 fertilizer in your 50 gal water tank. Calculate the amount of dry fertilizer.

   Answer__________ oz

4. African violets require only 50 ppm of 12-36-14 fertilizer. The African violet crop occupies only a small area of the greenhouse. A small portable injector unit with a 10-gal tank has been assigned to water this section. Calculate for nitrogen and determine how much fertilizer is to be added to the tank.

   Answer_________ oz

5. Harrison's greenhouse fertilizes once a week only. The greenhouse manager uses 20-20-20 at 500 ppm in a 50 gal tank. She sends you to weigh out and bring the correct amount of fertilizer for the tank. How much do you bring?

   Answer_________ oz

6. How much fertilizer goes into a 20 gal tank to make 300 ppm of a 5-10-20 fertilizer? Calculate for phosphorus.

   Answer_________ oz

## ASSIGNMENT ANSWERS — INTRODUCTION TO FERTILIZERS — XIII

**ASSIGNMENT SHEET 1**

1. a. Weight
   b. Name of fertilizer
   c. Components of fertilizer
   d. Contents of package
   e. Guaranteed analysis listing all nutrients by name and chemical symbol and percentages of each
   f. Hazardous warning on potentially dangerous fertilizers
   g. Instructions for storing and handling
   h. Name and address of manufacturer
2. a. 10%
   b. 20%
   c. 20%
   d. 50%
   e. 50%
3. a. 2
   b. 3
   c. 4
   d. 3
   e. 1 or 7
   f. 6

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## ASSIGNMENT SHEET 2

1. 13.3 $\frac{1.33 \times 200}{10} = \frac{266}{10} = \frac{26.6}{2} = 13.3$

2. 9.97 (10) $\frac{1.33 \times 300}{10} = \frac{399}{10}$ (400) $= \frac{39.9}{4}$ (40) $= 9.97$ (10)

3. 7.64 (7.65)

   $\frac{1.33 \times 230}{20} = \frac{305.9}{20}$ (306) $= \frac{15.29}{2}$ (15.3) $= 7.64$ (7.65)

4. .55 $\frac{1.33 \times 50}{12} = \frac{66.5}{12} = \frac{5.54}{12} = .55$

5. 16.62 $\frac{1.33 \times 500}{20} = \frac{665}{20} = \frac{33.25}{2} = 16.62$

6. 7.98 (8) $\frac{1.33 \times 300}{10} = \frac{399}{10}$ (400) $= \frac{39.9}{5}$ (40) $= 7.98$ (8)

**WRITTEN TEST**

# INTRODUCTION TO FERTILIZERS

# XIII

NAME ______________________ SCORE _______

**OBJECTIVE 1**

**Match terms associated with fertilizers to their correct definitions.** Write the correct letters in the blanks.

___ 1. Naturally-occurring fertilizer; usually animal or plant matter, also some minerals, and some human byproducts

___ 2. Fertilizer containing percentages of only one or two of the three major nutrients (nitrogen, phosphorus and potassium)

___ 3. Nutrient needed in large quantities for good plant growth

___ 4. Parts per million

___ 5. Nutrients are sprayed onto and absorbed through the leaves; especially effective in feeding plants micronutrients

___ 6. Nutrient needed in small quantities for good plant growth

___ 7. Common name for the nutrient group of nitrogen, phosphorus, potassium

___ 8. Fertilizer containing percentages of nitrogen, phosphorus and potassium

___ 9. Potassium in oxide form

___ 10. Can be dissolved in water

___ 11. Fertilizer manufactured with chemicals

___ 12. Phosphorus in oxide form

a. $P_2O_5$

b. NPK

c. Insoluble

d. Water soluble

e. Organic fertilizer

f. Inorganic fertilizer

g. Foliar fertilizer

h. NKP

i. Macronutrient

j. Phosphate

k. Manure

l. $K_5O_3$

m. Micronutrient

n. Complete fertilizer

o. $P_2O_3$

p. Incomplete fertilizer

q. $K_2O$

r. ppm

s. $KO_2$

**OBJECTIVE 2**

**Label components of complete fertilizer formula (Guaranteed analysis).** Write the correct names in the blanks.

20 - 10 - 20 = 40%

1.____________ 2.____________ 3.____________

4. What does the 40% mean____________________________

**OBJECTIVE 3**

**Distinguish values of essential plant food elements nitrogen, phosphorus, and potassium.** Write "N" in the blanks before statements that describe nitrogen, "P" in the blanks before statements that describe phosphorus, and "K" in the blanks before statements that describe potassium.

____1. Produces and matures the seed

____2. Deficiency causes small, thin plants with purplish foliage, sterile seed

____3. Carries carbohydrates through the plant system, forming strong stems and making the plant resistant to diseases

____4. Deficiency creates slow-growing, stunted plants with browning leaves and stunted fruits

____5. Produces strong root systems

____6. Deficiency causes yellow leaves and stunted growths

____7. Produces brighter and more beautiful flowers

____8. Produces leaf growth and green leaves

____9. Essential for all cell division and growth and is responsible for the strength of the plant

___10. Excess delays flowering, causes stems to grow too long, reduces quality of fruits and lowers resistance to disease

**OBJECTIVE 4**

**Match secondary elements necessary for growth and development to their correct descriptions.** Write the correct letters in the blanks.

___ 1. Promotes root growth. Deficiency causes young leaves to turn light green; stalks become long and slender

___ 2. Affects intake of plant nutrients; necessary for the formation of fats. Deficiency causes leaf veins to turn yellow and spotted. Stems grow tender and weak

___ 3. Promotes root formation and affects how the plant uses nutrients. Deficiency causes terminal buds to die at the tips and causes leaves to die around the edges

a. Magnesium

b. Copper

c. Sodium

d. Calcium

e. Manganese

f. Sulfur

**OBJECTIVE 5**

**Select from a list micronutrients required for plant growth and development.** Write an "X" in the blank before micronutrients required for plant growth and development.

___ 1. Magnesium

___ 2. Gypsum

___ 3. Calcium

___ 4. Iron

___ 5. Potash

___ 6. Zinc

___ 7. Xenolite

___ 8. Manganese

___ 9. Chlorite

___ 10. Molybdenum

___ 11. Copper

___ 12. Boron

**OBJECTIVE 6**

**Describe types of commercial fertilizers.** Give example(s) of each type.

- Granular —

  EXAMPLE:

- Timed-release —

  EXAMPLE:

- Water soluble —

  EXAMPLE:

**OBJECTIVE 7**

**Match indoor and outdoor application methods to their correct descriptions.** Write the correct letters in the blanks.

___ 1. Water-soluble fertilizer is added to the main water line; portable units allow specific fertilizer applications to specific greenhouse areas or specific crops

___ 2. Power-operated or hand-pumped unit applies dry fertilizer mixed with water over large areas such as lawns, vegetable or flower gardens

___ 3. Solid or spray fertilizer is hand-worked into large pots

___ 4. Nozzles divide water into smaller droplets for general watering, for watering seedlings and into tiny droplets for misting. A wand attachment is used to water hard-to-reach plants such as hanging baskets and outside benches

___ 5. Dry fertilizer mixed with water is applied with (1) a mister for foliar fertilizer, (2) a long-spout can for hanging plants or potted plants, or (3) a larger can for trees, shrubs, flowers and vegetables

___ 6. Fertilizer is mixed with water in a jar attached to the hose; water-soluble fertilizer is applied as plants are hand watered

___ 7. Pills, capsules or spikes release nutrients to the roots; used in individual pots

___ 8. Complete fertilizers and plant-specific nutrients and micronutrients are mixed into potting soil for transplanted seedlings and repotted plants; timed-release fertilizers mixed with transplanted seedling and repotting mix provide nutrients for 3-4 months

a. Hose-end injectors

b. Incorporated

c. Buried in soil

d. Pressure sprayer

e. Prill injectors

f. Top dressing

g. Fertilizer injectors

h. Hose-end sprayers

i. Pellet injectors

j. Water hose and water breakers

k. Hand-watering devices

**OBJECTIVE 8** **State rules for storing fertilizer bags.** List four rules.

**OBJECTIVE 9** **State regulations for handling fertilizers.** List three regulations.

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**OBJECTIVE 10**

**Select from the following list information required on fertilizer bags.** Write an "X" in the blank before information required on fertilizer bags.

___ 1. Fertilizer formula listing the percentage of carrier materials

___ 2. Name of fertilizer

___ 3. Name and address of manufacturer

___ 4. Net weight

___ 5. Percent of moisture

___ 6. Guaranteed analysis listing all nutrients by name and chemical symbol

___ 7. Color code for high-nitrogen content

___ 8. Type of fertilizer, such as granular, pelleted, etc.

___ 9. Fertilizer formula listing the percentages of NPK

___ 10. Yellow hazard symbol on potentially dangerous fertilizer

___ 11. Instructions for storing and handling

___ 12. ppm mixing procedures

___ 13. Red hazard symbol on potentially dangerous fertilizer

**NOTICE**

The following assignment sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 11**

**Analyze information required on fertilizer bags.** SCORE _______

**OBJECTIVE 12**

**Use fertilizer label and ppm to calculate amount of dry fertilizer to be added to an injector system tank.** SCORE _______

**WRITTEN TEST ANSWERS**

## INTRODUCTION TO FERTILIZERS

## XIII

### OBJECTIVE 1

1. e
2. p
3. i
4. r
5. g
6. m
7. b
8. n
9. q
10. d
11. f
12. a

### OBJECTIVE 2

1. Nitrogen
2. Phosphorus
3. Potassium
4. % plant food

### OBJECTIVE 3

1. K
2. P
3. K
4. K
5. P
6. N
7. P
8. N
9. K
10. N

### OBJECTIVE 4

1. f
2. a
3. d

### OBJECTIVE 5

4, 6, 8, 10, 11, 12

**OBJECTIVE 6**

1. Granular — Small pelleted form of dry fertilizer; to be dissolved in water or foliar spray

   EXAMPLES: MagAmp and Choice 10-10-10

2. Timed-release — Fertilizer designed for release over an extended period; available in quick, slow, and mid-release types; may be large pellets or prills (dry fertilizer core with water-soluble sulfur or plastic coating); is worked into soil, applied on top of soil, buried or dissolved in water; used in containers and on outside plants.

   EXAMPLES: Osmocote®, Plantabbs, Spikes

3. Water soluble — Dry fertilizer is mixed with water and used in greenhouses; applied through injector systems or sprayers

   EXAMPLES: Peters®, Miller's Booster, Nulife Soluble Plant Food

**OBJECTIVE 7**

1. h
2. d
3. f
4. j
5. k
6. h
7. c
8. b

**OBJECTIVE 8**

Answer must include

- Store in a dry area
- Store away from walls
- Store away from concrete floors; construct a wood rack to raise bags
- Keep bags sealed

**OBJECTIVE 9**

Answer must include

- Store high nitrogen-content fertilizers in a separate area from complete fertilizers
- In schools, fertilizers and all chemicals must be kept in a locked room and the location must be on file with the fire department

| | |
|---|---|
| | • Fertilizers containing herbicides are considered hazardous materials and must be stored in a locked room |
| **OBJECTIVE 10** | 2, 3, 4, 6, 10, 11 |
| **OBJECTIVE 11** | Refer to answers to Assignment Sheet 1. |
| **OBJECTIVE 12** | Refer to answers to Assignment Sheet 2. |

**OBJECTIVE SHEET**

# PLANT PROPAGATION

# XIV

**INTRODUCTION**

Plant propagation is a fascinating area in horticulture because, like any new birth, it is the creation of new life. Whether in a greenhouse with seeds and leaf cuttings making new plants, or in a nursery grafting and budding, propagation is a major operation. There are many methods to propagate different plants and plant parts; all of them requiring knowledge, skill, and practice. Whether your strength is in seeding flats or doing difficult grafting operations, you'll find this a challenging unit to study and learn.

**UNIT OBJECTIVE**

After completing this unit, the student should know methods of sexual and asexual plant propagation for greenhouse and nursery operations; be able to use Hardiness Zone Maps and Average Frost Date Maps; and be able to perform standard propagation procedures. The student will demonstrate these competencies by completing assignment sheets, job sheets, and written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with plant propagation to their correct definitions.
2. Distinguish between reasons for using sexual or asexual propagation methods.
3. Name parts of a seedling.
4. Arrange in order the steps in germination.
5. Describe factors that affect germination.
6. Name methods of seeding.
7. List types of seeds available.
8. Define methods of speeding germination.
9. Define scarification techniques.
10. Match factors affecting successful asexual propagation to their correct definitions.

11. Match types of asexual propagation for greenhouse operations to their correct descriptions.

12. Match types of asexual propagation methods for nursery operations.

13. Match types of stem cuttings to the proper season for taking cuttings.

14. Match types of layering to their correct definitions.

15. Name types of budding methods used in nursery operations.

16. Distinguish among types of grafts used in nursery production.

17. Identify hardiness zones. (Assignment Sheet 1)

18. Create zone and frost-date charts. (Assignment Sheet 2)

19. Determine planting and shipping dates. (Assignment Sheet 3)

20. Demonstrate the ability to

    a. Seed a flat with fine seeds. (Job Sheet 1)

    b. Scarify seeds by file or sandpaper method. (Job Sheet 2)

    c. Stratify seeds. (Job Sheet 3)

    d. Propagate herbaceous stem cuttings. (Job Sheet 4)

    e. Propagate a leaf cutting. (Job Sheet 5)

    f. Air layer plants. (Job Sheet 6)

    g. Propagate hardwood cuttings. (Job Sheet 7)

    h. Bud by t-bud method. (Job Sheet 8)

    i. Bud by patch method. (Job Sheet 9)

    j. Graft by whip and tongue method. (Job Sheet 10)

    k. Graft by bark graft method. (Job Sheet 11)

## SUGGESTED ACTIVITIES

## PLANT PROPAGATION

## XIV

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competency in the required procedures.

  **NOTE:** Job sheets may be seasonal; check your stock and the job sheets for best possible scheduling.

- Order materials to supplement unit.

  Bulk seed, pelleted seed, and seed tape, if not already in stock

- Start leaf and stem cuttings and air layering ahead of time so students can see expected results of their work.
- Grow or obtain plant material for students to practice cutting at angles with a sharp knife, cutting with a double-blade knife, and girdling.
- Refer to Unit 7, *Plant Growth and Responses* for a review of plant morphology, plant growth, and responses.
- If you do not have nursery stock available for grafting, arrange with a local nursery or greenhouse for a demonstration either in your classroom or at the nursery.

  **NOTE:** Supply lecturer/demonstrator with the Objective Sheet, Information Sheet, and any other components you want covered in the demonstration.

- Invite an extension agent, horticulturist, or research scientist to discuss genetics and propagation by tissue culture.

  **NOTE:** Supply guest speaker with the Objective Sheet, Information Sheet, and any other components you want them to cover.

**DELIVERY**

**Objective 1**

- Review terms and definitions with students.
- Show them samples of grafting tape, budding rubbers, and grafting wax. Refer them to Supplement 1, Hardiness Zone Map.

**Objective 2**

- Discuss plants in your greenhouse that are reproduced by sexual and asexual propagation methods.
- Show VHS, *Plant Propagation*.
- Discuss cloning and propagation by tissue culture.

**Objectives 3 through 7**

- Germinate seeds in paper towels or wash cloths so students can identify all parts of the seedling and stages of development as it emerges. Use bulk seed, pelleted seed and a small section of seed tape.
- Plant seeds and vary the factors that affect germination so students can observe and study the consequences of inappropriate temperature, humidity, darkness, and light, etc.
- Allow students to germinate monocot and dicot seeds to observe and study the different emergent plant parts. Plant enough so that seedlings can be removed from the soil and studied during the growth process.
- Distribute Supplements (Objective 5)

  Supplement 1—Hardiness Zone Map

  Supplement 2—Dates of the last killing frost in spring (USDA *Home and Garden* Bulletin 202)

  Supplement 3—Dates of the first killing frost in fall (USDA *Home and Garden* Bulletin 202)

- Distribute Assignment Sheets (Objective 5)

  Assignment Sheet 1—Identify hardiness zones.

  Assignment Sheet 2—Create zone and frost-date charts.

  Assignment Sheet 3—Determine planting and shipping dates.

- Distribute Job Sheet 1—Seed a flat with fine seeds. (Objective 6)

**Objectives 8 and 9**

- Discuss reasons for speeding germination and for forcing seeds and bulbs.
- Discuss the plants in your greenhouse for which forcing might be desirable.
- Distribute Job Sheet 2—Scarify seeds by file or sandpaper method. (Objectives 8 and 9)
- Distribute Job Sheet 3—Stratify seeds. (Objective 8)
- You may wish to demonstrate acid treatment. For safety reasons, that job sheet has been removed from the unit.

**Objectives 10 through 16**

- Select the objectives appropriate to your program and your facilities.

  **NOTE:** Objectives list propagation methods for greenhouse operations and nursery operations separately.

- Invite a guest speaker or arrange a field trip for students to observe and study the areas not covered in your program or out of season at the time these objectives are to be taught.
- Distribute appropriate Job Sheets.

  Job Sheet 4—Propagate herbaceous stem cuttings. (Objective 11)

  Job Sheet 5—Propagate a leaf cutting. (Objective 11)

  Job Sheet 6—Air layer plants. (Objective 14)

  Job Sheet 7—Propagate hardwood cuttings. (Objective 15)

  Job Sheet 8—Bud by T-bud method. (Objective 15)

  Job Sheet 9—Bud by patch method. (Objective 15)

  Job Sheet 10—Graft by whip and tongue method. (Objective 16)

  Job Sheet 11—Graft by bark graft method. (Objective 16)

## APPLICATION

### Objectives 17 through 19

- Use Assignment Sheet 1 to give students experience and practice with hardiness zones.
- Use Assignment Sheet 2 to give students experience and practice reading frost-date maps, identifying local zones, and low temperatures, and for reinforcing geographical knowledge.
- Use Assignment Sheet 3 to reinforce the need for careful planning and to support math skills.

### Objective 20

- Use job sheets to give students hands-on, practical experience with greenhouse and nursery propagation methods.

## EVALUATION

### Practical test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

### Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *Plant Propagation*, Vol. 1 and 2, 1/2" VHS, color, 40 min., 1987. Volume 1 covers propagation by seed, specialized parts, division, and micro-propagation. Volume 2 covers cuttings, layering, grafting, and budding. It details rooting hormones and the four main groups of stem cuttings. Order VT122

- *How to Grow and Nurture Seedlings* in gardening. 1/2" VHS, color, 49 min., 1988, Burpee.

  **NOTE:** These films are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

## UNIT REFERENCES

- Baudendistel, Robert J. *Horticulture: A Basic Awareness*. Reston: Reston Publishing Company, 1978
- Hartmann, Hudson T., and Kester, Dale E. *Plant Propagation, Principles and Practices*. Englewood Cliffs: Prentice-Hall, Inc., 1975
- *Horticultural Occupations, Catalog No. 31B*, 2nd edition. College Station, Texas: Texas A & M University, Instructional Materials Service, 1985.
- *Nursery Operations*. Unit Guide 5: Propagation. Tallahassee: State of Florida Department of Education, 1977.
- Reiley, H. Edward & Carroll L. Shry, Jr., *Introductory Horticulture*, 3rd edition. Albany, N.Y.: Delmar, 1988.
- Richardson, William B., and Moore, Gary B., *Working in Horticulture*. New York: Gregg Division/McGraw-Hill Book Company, 1980.

**OBJECTIVE 1**

**Match terms associated with plant propagation to their correct definitions.**

- **Sexual propagation**—Reproduction involving female (egg) and male (pollen) sex cells producing seed; seeds make new plants
- **Asexual propagation**—Reproduction using cuttings from leaves, stems, or roots to make new plants
- **Germination**—Seed begins to grow
- **Furrow**—A narrow groove made in the soil
- **Dormancy**—Rest period required for some seeds to germinate; naturally occurs in late fall and winter
- **Hardiness zones**—Climate areas defined by lowest temperatures
- **Grafting**—Method of attaching twigs, buds, or roots onto other stems or roots so that tissues are joined and a new plant results
- **Herbaceous**—Non-woody; type of plants grown in greenhouse operations
- **Semi-hardwood**—Current year's growth on a hardwood plant at the end of the growing season
- **Hardwood**—Plant that develops a woody stem
- **Evergreen**—Plant that retains its leaves all year
- **Rootstock**—(Stock plant) Plant that receives a graft or bud
- **Scion**—Portion of the plant attached to rootstock or another twig during grafting
- **Budding**—Special type of grafting where a single bud is used as a scion
- **Budstick**—Twig used as a source of buds when budding
- **Budding rubbers**—Narrow strips of rubber used to tie grafts and buds in place; used to prevent drying

- **Girdle**—To cut a section of bark and cambium completely around a stem
- **Viable**—Able to live
- **Grafting tape**—Non-stick plastic tape used to hold buds and grafts in place; and to prevent drying
- **Grafting wax**—Used to seal grafts
- **Polarity**—Tendency for a cutting to sprout roots from the bottom end and sprout shoots from the top

**OBJECTIVE 2**

**Distinguish between reasons for using sexual or asexual propagation methods.**

NOTE: A third method of propagation is now in use. Propagation by tissue culture uses advanced technology to clone new plants from genetic plant material. Propagation occurs under precisely-controlled laboratory conditions.

**Sexual propagation**

- Some plants can reproduce only by seed
- Some plants are easier and cheaper to propagate sexually
- Growers can produce new and better plants by careful breeding

**Asexual propagation**

- New plants are identical to parent plants

  NOTE: Many fruit trees do not produce fruit true to the parent plant when they reproduce from seed.
- Some plants are easier and cheaper to propagate asexually
- Some plants do not have seeds
- Grafting and budding onto rootstocks can give plants the ability to resist disease or other damage
- Larger plants can be grown faster

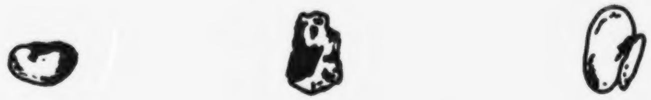
**OBJECTIVE 3**

**Name parts of a seedling.**

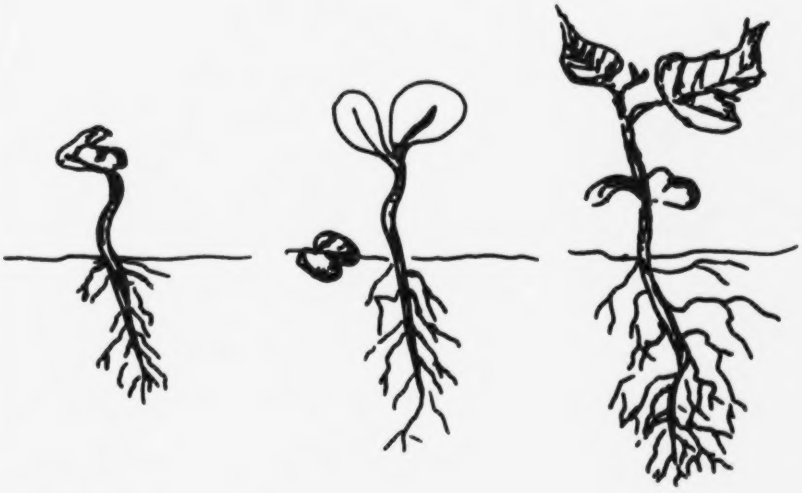
- **Seed coat**—Outer layer of the seed (Figure 1b)
- **Radicle**—First root to emerge (Figure 1c)
- **Plumule**—(Plume-yul) Shoot or seed bud that emerges from the soil or growing medium (Figure 1d)
- **Cotyledon**—(cot-uh-LEE-dun) First leaves to appear on a plant (Figure 1e)

**NOTE:** Cotyledons are also called "seed leaves." Plants with single cotyledon are monocots. Corn is a monocot. Plants with a two seed leaves, such as marigolds, are dicots.

FIGURE 1



a. Seed b. Seed Coat c. Radicle



d. Plumule e. Cotyledons f. True Leaves

**OBJECTIVE 4**

**Arrange in order the steps in germination.**

1. Seed soaks up water (Figure 1a)
2. Seed coat softens and swells
3. Seed coat splits open (Figure 1b)
4. The radicle grows downward (Figure 1c)
5. The shoot grows upward (Figure 1d)
6. The cotyledons open from the shoot (Figure 1e)
7. First true leaves open (Figure 1f)
8. Cotyledons dry and fall off; the plant develops leaves and a root system and continues to grow

**OBJECTIVE 5**

**Describe factors that affect germination.**

NOTE: Seeds have specific requirements that affect planting time and growing conditions. Planting instructions usually accompany seeds or are available from charts in seed catalogs.

- **Properly prepared seedbed**—Soil or medium should provide drainage and aeration
- **Temperature**—Should be controlled according to seed requirements for cold or heat

  NOTE: Some seeds, such as geraniums, require a constant temperature to germinate, and if the temperature varies, germination will be delayed.

- **Moisture**—Must be carefully watched so seeds are neither too wet nor too dry

  NOTE: Some seeds, such as okra, will sprout only when the soil is very hot and dry.

- **Darkness or light**—Exposure must meet seed requirements

  EXAMPLES: Most seeds need darkness. Gerber daisies need light to germinate, canterbury bells need alternating dark and light periods.

- **Air**—Proper circulation is needed for germination

- **Depth of planting**—Usually 2 to 3 times the diameter of the seed. Very small seeds are sown on the surface.

- **Winter freezing**—Some seeds must live in the frozen ground over the winter before they will germinate

**OBJECTIVE 6** **Name methods of seeding.**

- **Furrow method**—Used for small- and medium-sized seeds. In garden areas, furrows are made with a hoe. In the greenhouse, they are made with a finger or a small tool. Furrow method is used for (1) seeding flats filled with soilless medium and (2) direct seeding in soil and in soil-filled benches.

  EXAMPLES: Periwinkle, petunia, tomato

- **Individual seed method**—Used for medium-large and large seeds. The seeds are placed in soil or medium by hand. Bedding plants are often seeded with this method to avoid transplanting later.

  EXAMPLES: Marigold, pecan

- **Automated equipment method**—Used in large commercial operations for specialized growing.

  **NOTE:** Plug seeders are the most common types of equipment. The sower drops seeds into small plugs or pockets of plant media at the rate of 11,000-60,000 seeds per hour.

  EXAMPLES: Petunia, begonia, defuzzed tomato seeds, detailed (with tails removed) marigold seeds

**OBJECTIVE 7** **List types of seeds available.**

**NOTE:** Good seed selection is very important. Always select varieties recommended for your specific area.

- Bulk pack or loose seed

- Pelleted or encapsulated

  **NOTE:** Seeds are coated to make them larger for easier handling.

- Seed tapes

**OBJECTIVE 8** **Define methods of speeding germination.**

NOTE: Seeds have different germination requirements. Some need light to germinate, others require darkness. Temperature and moisture are also factors.

- **Scarification**—Altering the seed coat to allow water penetration into the seed so that the seed can grow faster. Scarification breaks the tough seed coat, increases germination rate, and increases water absorption. (See Objective 9)

  EXAMPLES: Mimosa, redbud, and peach seeds are normally scarified.

- **Stratification**—Cold treatment given to some types of seed to complete ripening and overcome dormancy. Plants are placed in a moist environment in temperatures just above freezing.

  NOTE: The seed responds as if spring thaw and rains had occurred, signalling the seed to begin germination.

  EXAMPLE: Pecans are normally stratified to speed germination.

**OBJECTIVE 9** **Define scarification techniques.**

- **Acid treatment**—Seeds are placed in sulfuric acid solution for a certain length of time to help soften the seed coat
- **File or sandpaper technique**—Seed coat is notched by filing a small indentation
- **Soaking**—Seeds are soaked overnight in water

**OBJECTIVE 10** **Match factors affecting successful asexual propagation to their correct definitions.**

- **Time of cutting**—Different types of cuttings are taken at different times of year for best rooting results
- **Health of plant**—Cutting should have enough food to last until roots have formed
- **Age of cutting**—Cuttings generally should be taken from new growth
- **Position of cutting**—Cutting should be taken just below a node because hormones build up at the nodes and new roots form there

- **Type of rooting medium**—Should be a sterile mix, free from disease or pests, that provides proper drainage and aeration
- **Moisture**—Must be adequate to prevent drying
- **Proper equipment**—Automatic intermittent heat and misting systems
- **Temperature**—Should be within the proper range for the specific plant in order for propagation to occur
- **Light**—Should meet exposure requirement for the specific plant
- **Bottom heat**—Must be artificially provided to insure propagation will occur
- **Humidity**—Misting systems should keep plants from drying out

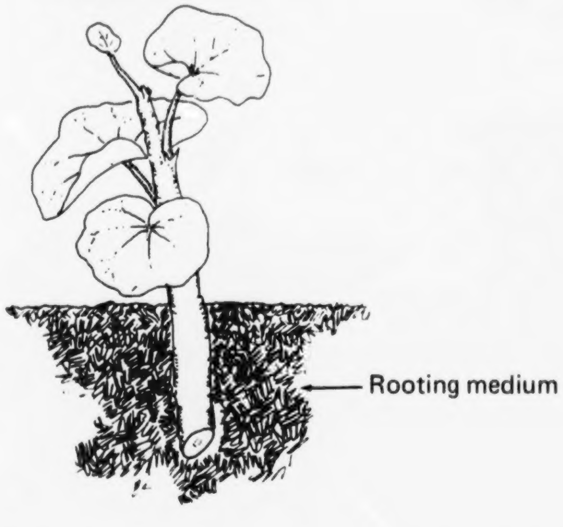
**OBJECTIVE 11**

**Match types of asexual propagation for greenhouse operations to their correct descriptions.**

- **Stem cuttings**—Most common method for indoor plants; should include at least 3 nodes per cutting; tip cuttings are preferred over stems which have been cut before to prevent a branched plant (Figure 2)

  EXAMPLES: Geranium, coleus, Swedish ivy

  FIGURE 2

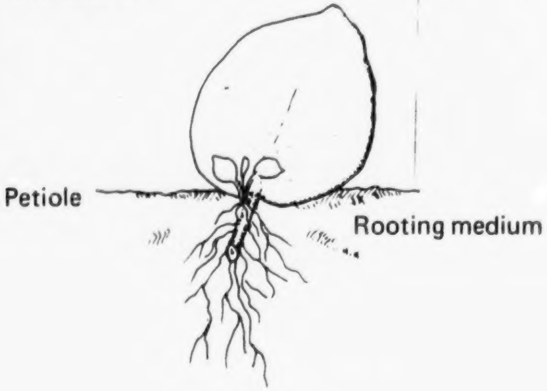


Robert F. Baudendistel, HORTICULTURE: A Basic Awareness, 2e, © 1982, pp. 50, 52, 54, 55, 57. Reprinted by permission of Prentice-Hall, Inc., Englewood Cliffs, NJ.

- **Leaf cuttings**—Include leaf and petiole; plantlet grows from base of petiole (Figure 3)

  EXAMPLES: African violet, begonia

  FIGURE 3

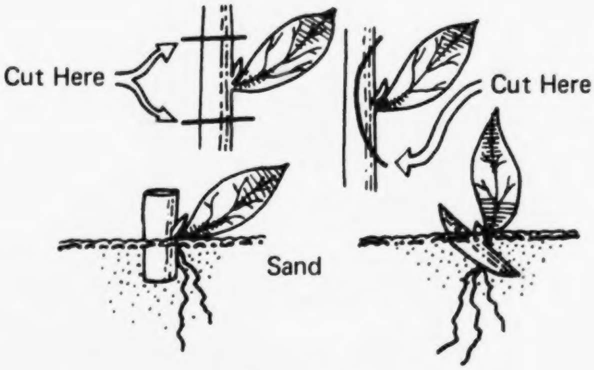

Petiole
Rooting medium

Leaf Cutting

- **Leaf-bud cuttings**—Must include a bud at a node for a plant to develop (Figure 4)

  EXAMPLE: Jade leaves will root but the plantlet will not develop unless a bud is included with the leaf

  FIGURE 4


Cut Here
Cut Here
Sand

Leaf-Bud Cuttings

- **Root cuttings**—Roots are bundled and stored at 40° F for 3 weeks; cuttings are planted 2-3 inches apart in final location

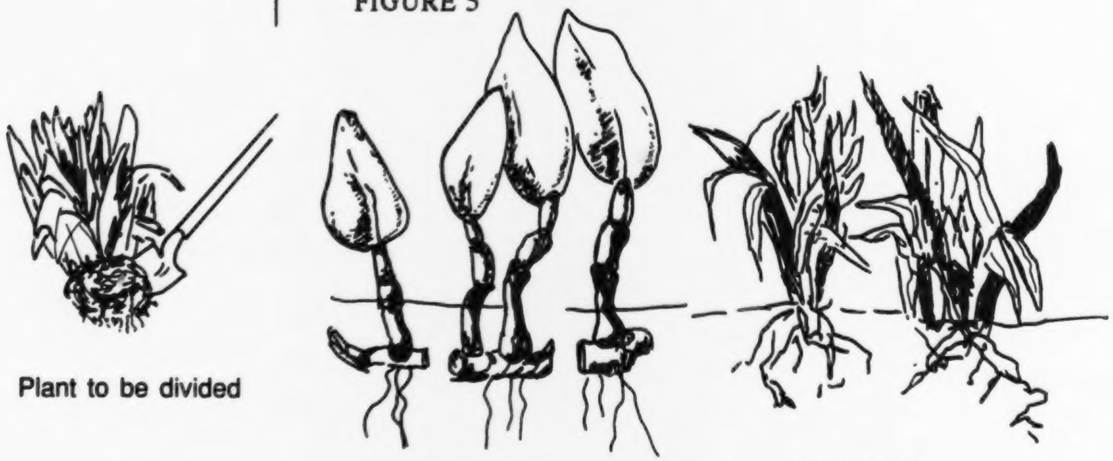
  EXAMPLES: Oriental poppy, lilac, white poplar, flowering crabapples, blackberry

- **Layering**—Plants are rooted while still attached to parent plant (See Objective 14)

  **NOTE:** The stem or root that is rooted is called a layer.

- **Division**—Plants are spread by underground roots or stems (Figure 5)

FIGURE 5



Plant to be divided

Root or Stem Section

New plants

**NOTE:** Division is also used in nursery and landscaping operations.

EXAMPLES: Stems—Sansevieria, iris, daylily, ferns
Roots—Liriope, lilac bush and some shrubs and trees

- **Separation**—Plants may spread by above-ground stems; bulbs form bulblets attached to side of bulb

  **NOTE:** Separation is also used in nursery and landscaping operations.

  EXAMPLES: Gladiolus and hyacinth spread by bulblets; strawberry begonia and spider plant spread by above-ground stems

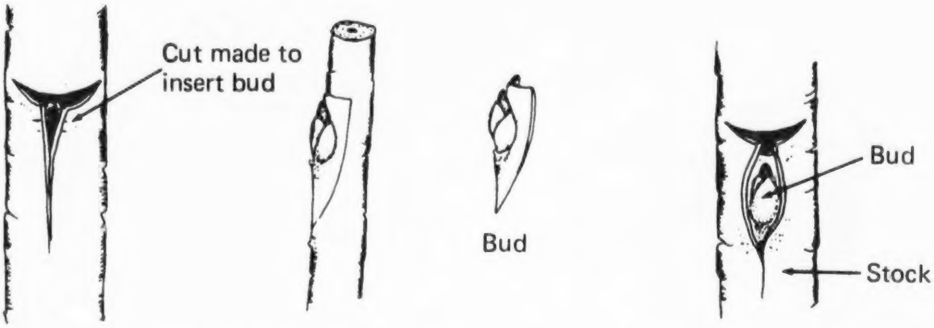
**OBJECTIVE 12** **Match types of asexual propagation methods for nursery operations.**

**NOTE:** Where greenhouse operations work with herbaceous plants, nursery operations work with semi-hardwoods, hardwoods, and evergreens.

- **Budding**—Bud is attached to stock plant by various means to produce a more desirable plant (Figure 6)

  EXAMPLES: Pecan, peach walnut

  FIGURE 6



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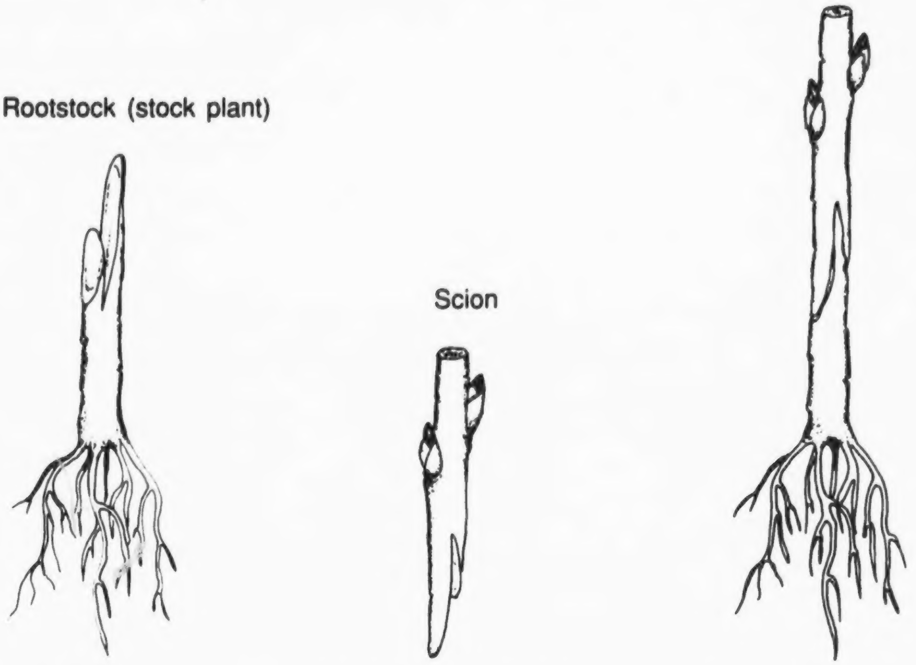
- **Grafting**—Scion is attached to stock plant by various means to produce a more desirable plant (Figure 7)

  EXAMPLES: Pecan, walnut, apple, peach

  **NOTE:** In budding and grafting, the two plants used must be closely related for propagation to succeed.

FIGURE 7 (Grafting)



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**OBJECTIVE 13**

**Match types of stem cuttings to the proper season for taking cuttings.**

- **Herbaceous**—Can be taken at any time

  EXAMPLES: Swedish ivy, peperomia

- **Semi-hardwood**—Taken from new growth or in the fall or from old growth in the winter

  EXAMPLES: Pyracantha, azalea

- **Hardwood**—Taken from new growth in the fall or from old growth in the winter

  EXAMPLES: Crape myrtle, honeysuckle

- **Narrowleaf evergreens**—Taken in the fall or early winter

  EXAMPLES: Junipers, pines

**OBJECTIVE 14**

**Match types of layering to their correct definitions.**

- Stem or air layering—Part of the plant stem is girdled or slit and then packed in a moist growing medium such as sphagnum moss and wrapped in plastic. Roots form where the plant has been wounded. (Figure 8)

  EXAMPLES: Chinese evergreen, rubber plant, Persian lime, magnolia

FIGURE 8a

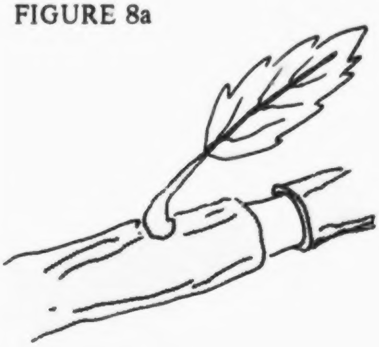
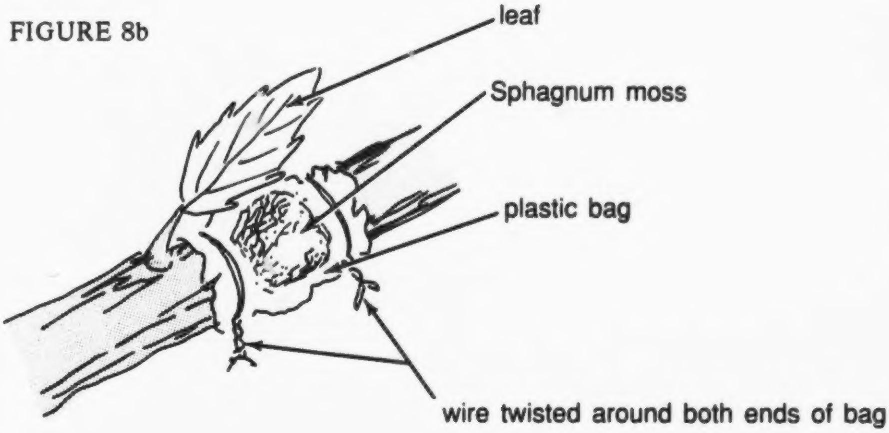


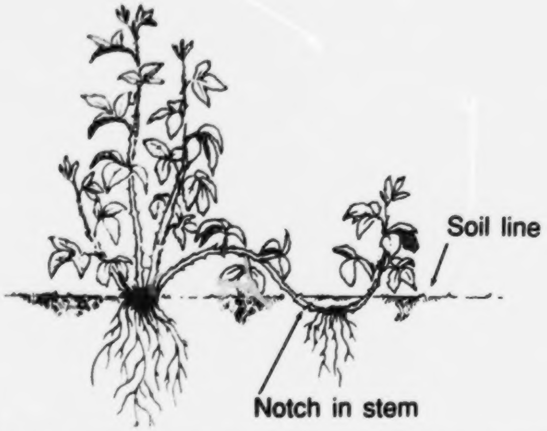
FIGURE 8b


leaf
Sphagnum moss
plastic bag
wire twisted around both ends of bag

- **Tip layering**—A stem is pulled to the ground, wounded near the tip and buried at the wound. (Figure 9)

  EXAMPLES: Azalea, blackberry

FIGURE 9 (Tip layering)


Soil line
Notch in stem

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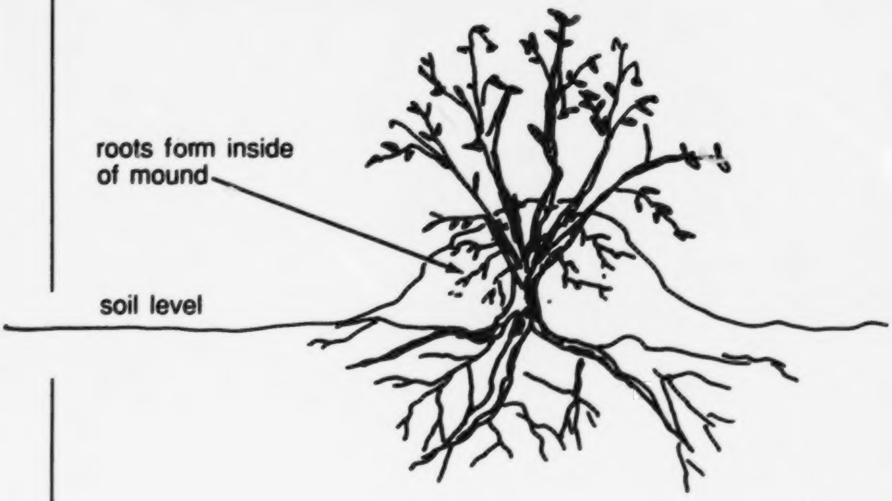
- **Mound layering**—Mother plant is cut to soil level and the stem is covered with soil. As shoots appear, more soil is added. The shoots are cut free and planted in early spring. (Figure 10)

EXAMPLES: Roses, apples

FIGURE 10

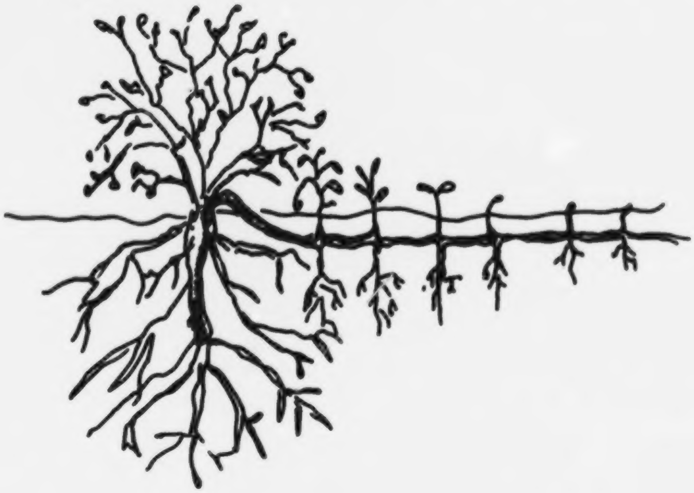

roots form inside of mound
soil level

- **Trench layering**—The mother plant is bent to the ground and buried. Shoots arise from the buds and roots form underground. The shoot is cut off and replanted. (Figure 11)

  EXAMPLES: Apples, azaleas

  NOTE: This method enables many new plants to be started at the same time.

  FIGURE 11

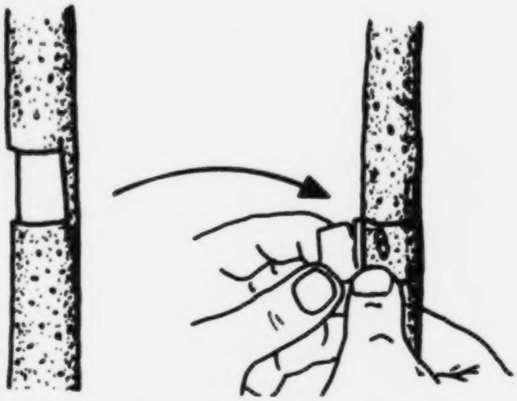


**OBJECTIVE 15** **Name types of budding methods used in nursery operations.**

NOTE: Trees must be actively growing at the time of budding.

- **Patch**—Transfer of bud and bark only, no wood included; one of the easiest methods (Figure 12)

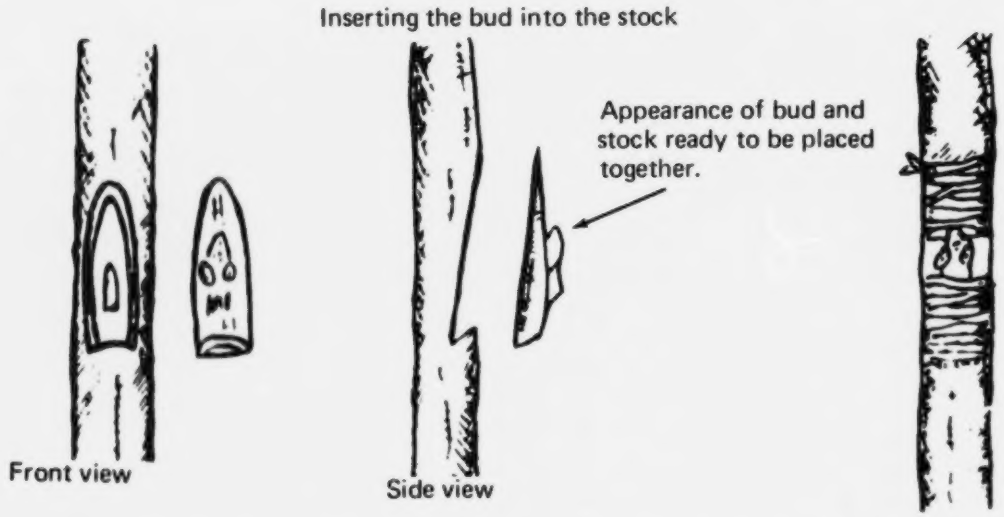
FIGURE 12 (Patch)



Courtesy of Oklahoma State University Cooperative Extension Service

- **Chip bud**—Must include the wood behind the bud; difficult to fit size of bud to stock (Figure 13)

FIGURE 13

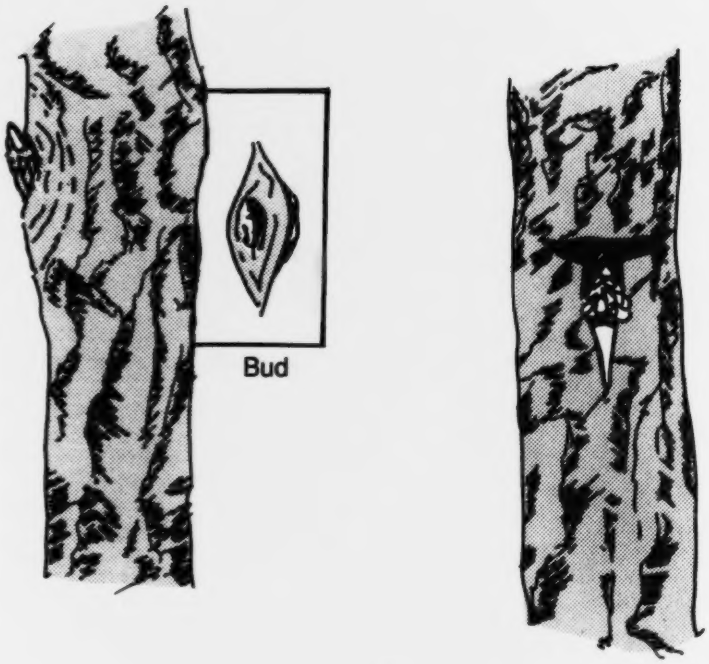

Inserting the bud into the stock
Appearance of bud and stock ready to be placed together.
Front view
Side view

Hartmann/Kester, PLANT PROPAGATION: Principles and Practice, 4/E, © 1983, p. 467. Reprinted by permission of Prentice-Hall, Inc., Englewood Cliffs, NJ.

- **T-bud**—May or may not include wood behind the bud (Figure 14)

**NOTE:** If wood is removed, the vascular system to the bud must remain intact and extend slightly out the back of the bud.

FIGURE 14

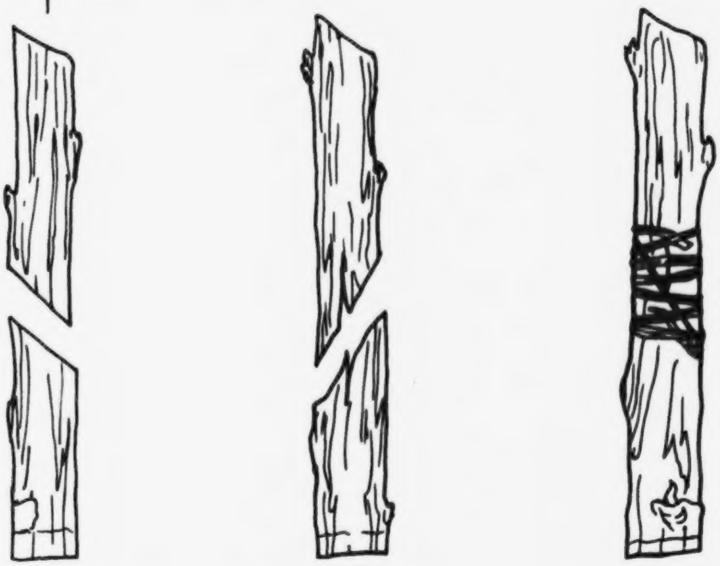


**OBJECTIVE 16** **Distinguish among types of grafts used in nursery production.**

- **Whip and tongue**—Used for hardwood cuttings, roots, and rootstock scion grafts; fairly simple method; can be done any time (Figure 15)

  EXAMPLES: Grape, pecan, rose, orange

  FIGURE 15 (Whip and tongue)



The sloping cuts made on the stock and scion.

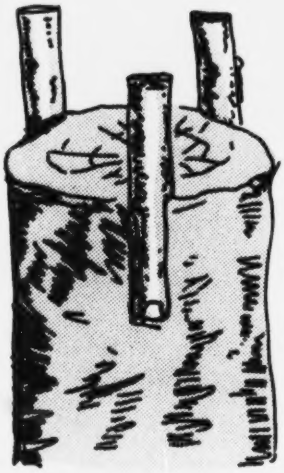
The tongues cut and opened out.

The graft completed and ready for callusing.

- **Bark**—Scion is inserted under the bark; extremely easy method; must be done when bark is slipping on the stock; scion must be dormant (Figure 16)

  **NOTE:** The bark is slipping when the cambium is actively growing and can be pulled back easily.

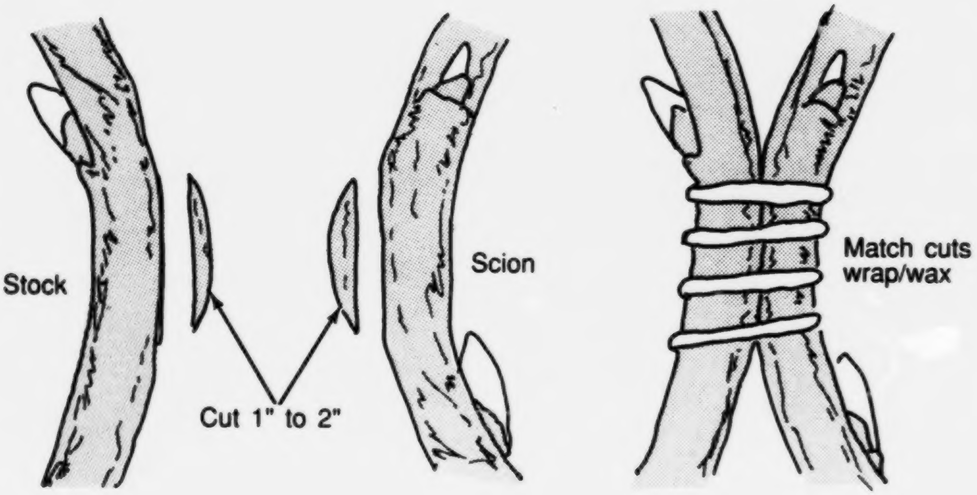
  FIGURE 16 (Bark)



- **Approach**—Used to propagate plants that are difficult to root or that do not have viable seed; can be done on herbaceous and woody materials; V-shaped wound is susceptible to disease and insect problems (Figure 17)

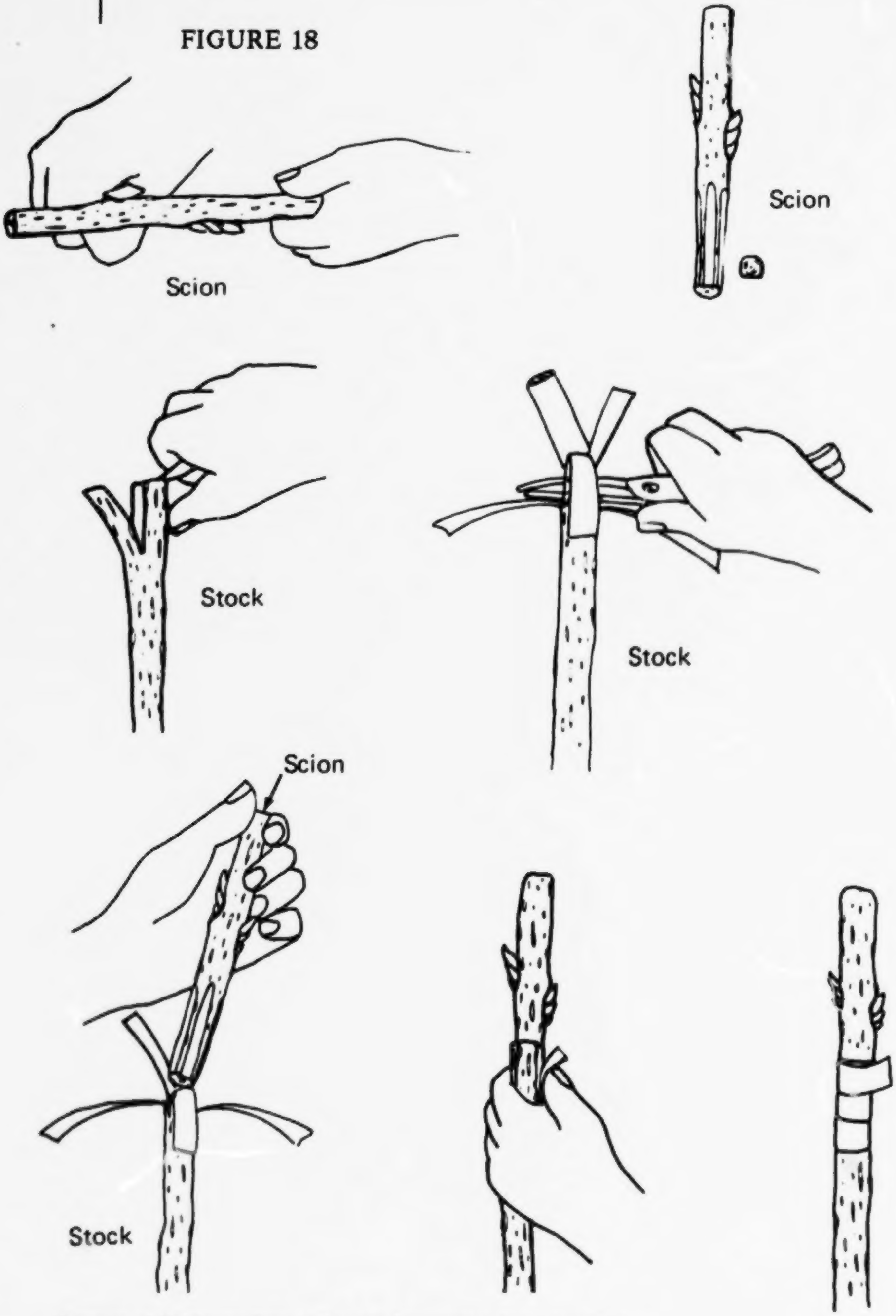
  EXAMPLE: Ficus (Weeping fig)

  FIGURE 17

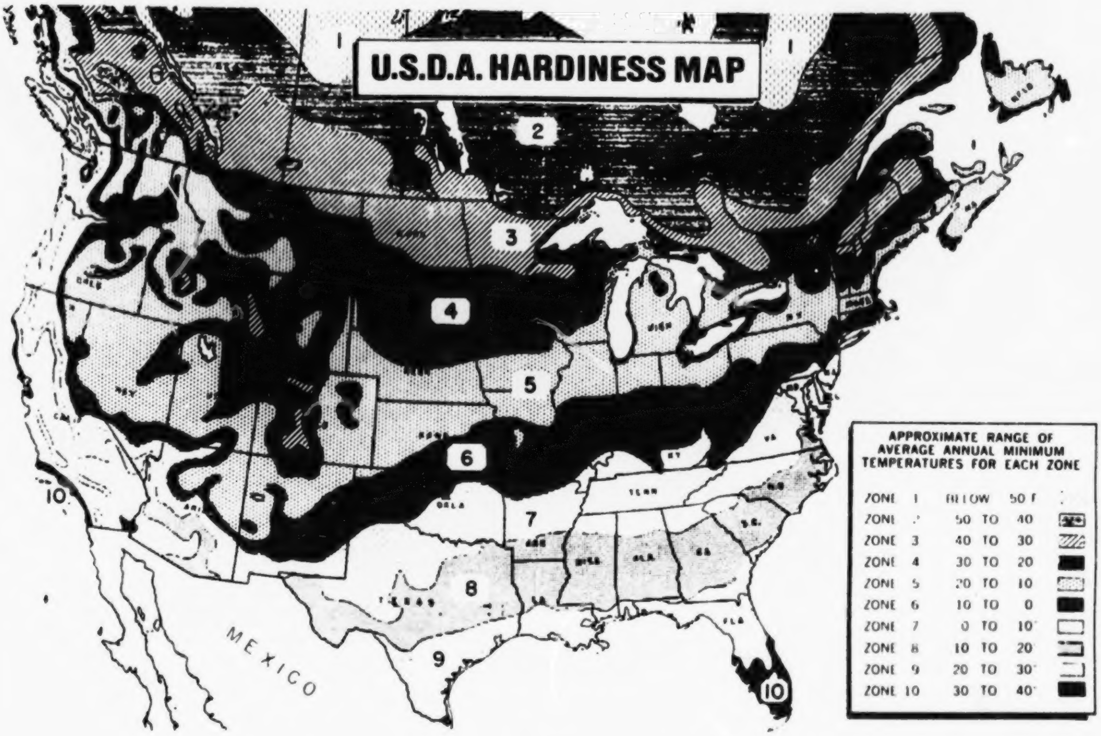

Stock
Cut 1" to 2"
Scion
Match cuts
wrap/wax

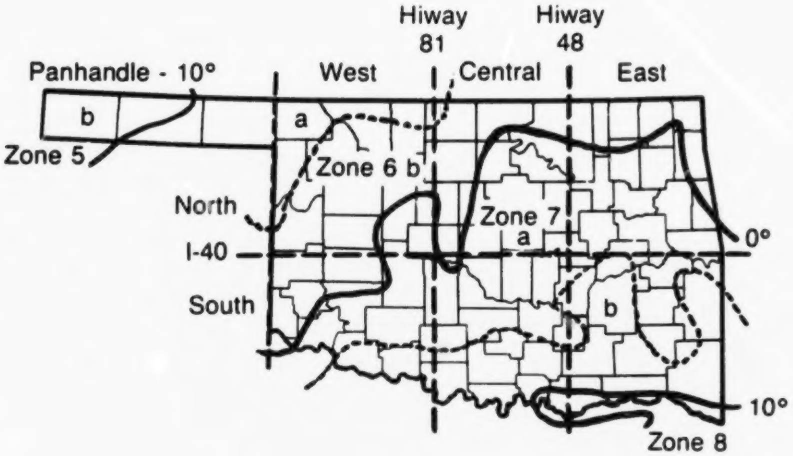
- **Four-flap (banana)**—Four vertical cuts on the stock; used any time the plant is active; very easy method (Figure 18)

FIGURE 18


Scion
Scion
Stock
Stock
Scion
Stock

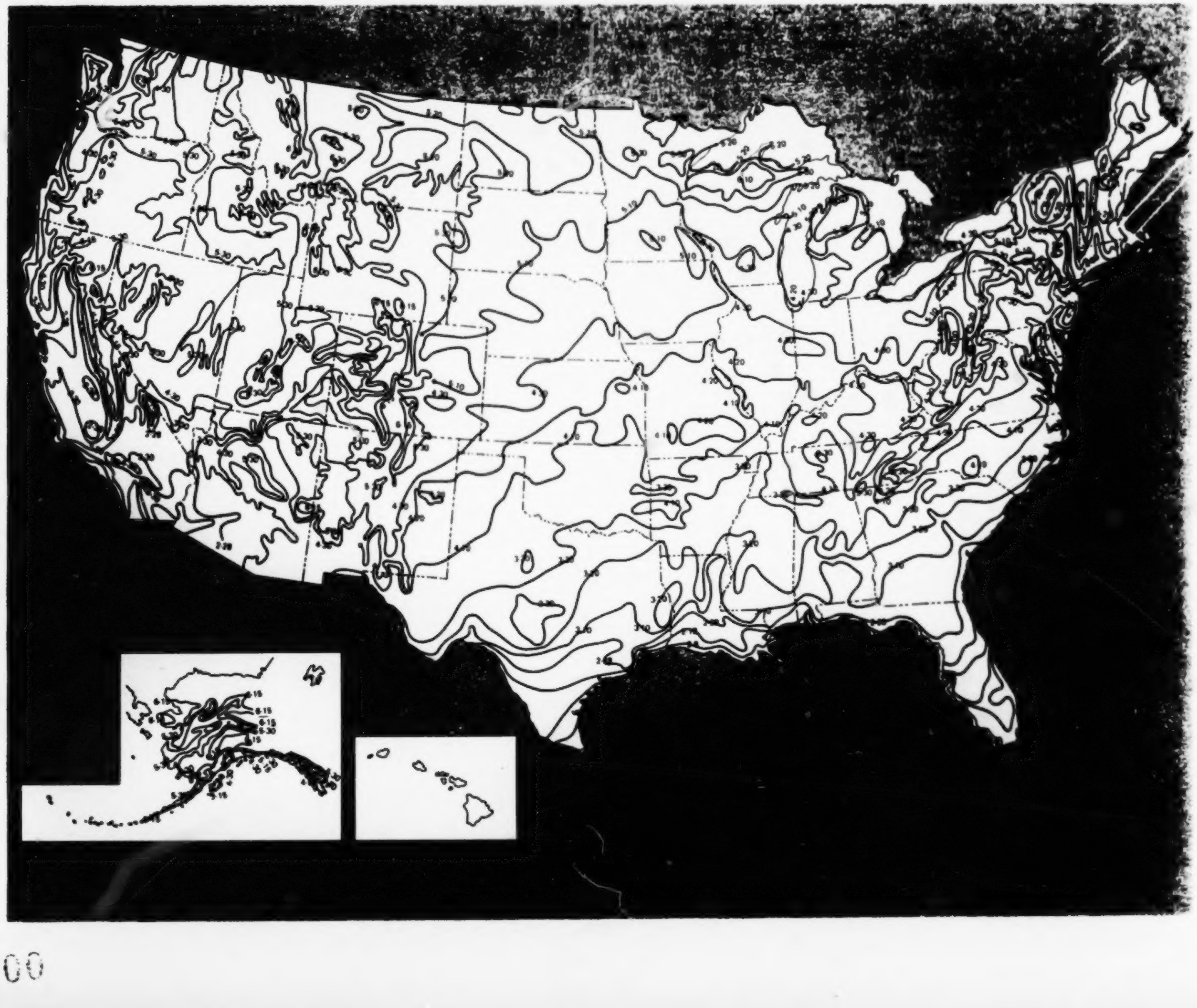
Courtesy of Oklahoma State University Cooperative Extension Service


U.S.D.A. HARDINESS MAP
1
1
2
3
4
5
6
7
8
9
10
10
MEXICO
APPROXIMATE RANGE OF AVERAGE ANNUAL MINIMUM TEMPERATURES FOR EACH ZONE
ZONE 1 BELOW 50 F
ZONE 2 50 TO 40
ZONE 3 40 TO 30
ZONE 4 30 TO 20
ZONE 5 20 TO 10
ZONE 6 10 TO 0
ZONE 7 0 TO 10°
ZONE 8 10 TO 20°
ZONE 9 20 TO 30°
ZONE 10 30 TO 40°

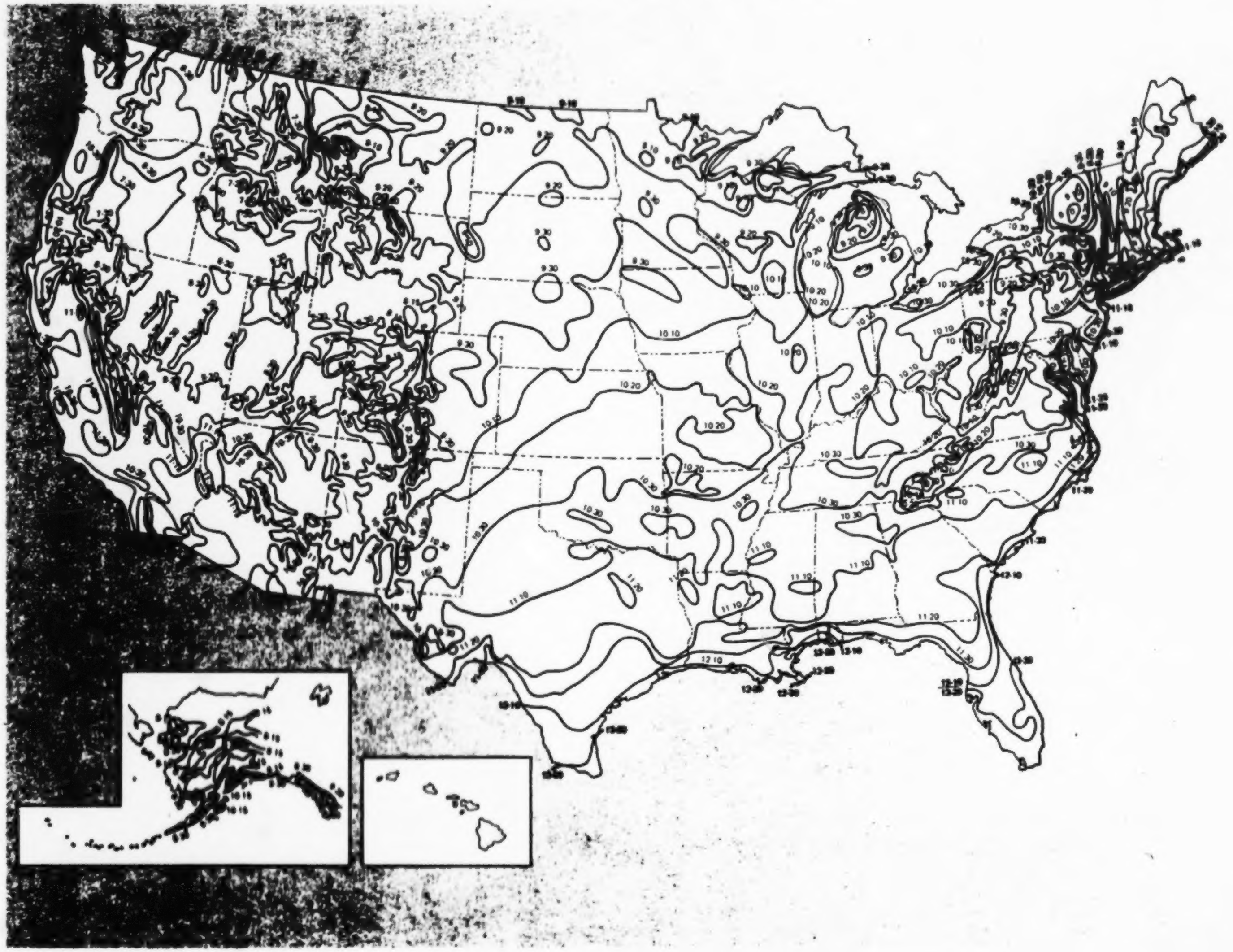

Hiway 81
Hiway 48
Panhandle - 10°
West
Central
East
b
a
Zone 5
Zone 6 b
North
Zone 7
a
0°
I-40
South
b
10°
Zone 8

OKLAHOMA HARDINESS MAP

MEAN DATE OF LAST 32° (F.) TEMPERATURE IN SPRING



## MEAN DATE OF FIRST 32° (F.) TEMPERATURE IN AUTUMN


9 10
9 20
9 30
10 10
10 20
10 30
11 10
11 20
11 30
12 10
12 20

**ASSIGNMENT SHEET 1**

# PLANT PROPAGATION XIV

NAME ______________________________ SCORE ______

**OBJECTIVE 17** **Identify hardiness zones.**

**INTRODUCTION**

A plant's ability to grow is affected by severe winter cold or high summer temperatures. "Hardy" means that a plant will withstand the lowest temperatures likely to occur during the winter. Seeds have natural preferences for a certain temperature range; seeds and plants are bred for hardiness.

A hardiness zone is identified by the average lowest temperature. The Hardiness Zone Map (Supplement 1) helps growers select the plant varieties best suited to their particular growing areas. Zones are numbered from north to south with lower numbers representing colder zones.

- Zones 7-8 are considered "mild winter areas."
- Vegetables that over-winter to mature in the spring are generally suitable for zones 6-9.
- Zones 9 and 10 are citrus-growing areas.

Quality seed catalogs will state the zones where a particular plant will thrive.

EXAMPLES: *Burpee Catalog* Oriental Poppy "Hardy in zones 4-8," means that north of zone 4 is too cold for the plant and south of zone 8 is too warm.

*Gurney's Catalog* Spirea vanhouttei "Hardy zones 3-8," means that the spirea will grow north of Florida and central Texas all the way to the Canadian border.

You must know your own zone and be able to select seed varieties that are hardy for your area and for areas where your plants are to be sold. Greenhouses and nurseries that ship seeds and plants set shipping dates according to hardiness zones and average dates of the last killing frost (See Supplements 2 and 3 and Assignment Sheet 2).

**DIRECTIONS**

Use the Hardiness Zone Map to answer questions about zones and lowest temperatures.

1. What is your zone? ______________________________

2. What is the lowest temperature in your zone according to the scale on the Hardiness Zone Map?

   ______________________________

3. List all the zones in your state, describe the area and write in the lowest temperatures.

   EXAMPLE: (I am in zone 5 in south central Idaho.) Zone 6 in western and northwestern Idaho—10° to 0° F.; zone 4 in north central and eastern Idaho—30° to -20° F.; and a single area of zone 3 in central Idaho—40° to -30° F.

   ______________________________
   ______________________________
   ______________________________
   ______________________________
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   ______________________________
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   ______________________________
   ______________________________
   ______________________________
   ______________________________

4. What is the lowest temperature of the coldest zone on the map?

Zone_____________Location__________________

Lowest temperature____________________________________

5. What is the lowest temperature of the warmest zone on the map?

Zone_____________Locations_________________

___________________________________________________

Lowest temperature____________________________________

**ASSIGNMENT SHEET 2**

# PLANT PROPAGATION

# XIV

NAME ______________________ SCORE ______

**OBJECTIVE 18**

**Create zone and frost-date charts.**

**INTRODUCTION**

Air temperature and soil temperature make a critical difference in the success of soil germination and planting transplants outdoors. Horticulturists use three tools as a guide for planning seeding, transplanting, and sales operations:

- Hardiness Zone map (Supplement 1)
- Average dates of the last killing frost in spring (Supplement 2)
- Average dates of the first killing frost in the fall (Supplement 3)

**DIRECTIONS**

Use Supplements 1, 2, and 3 to complete the charts on this page and the next.

1. Locate your zone and the zones for 2 states north and 2 states south of you, and complete this chart:

| | Zone | Date of last killing frost | Date of first killing frost |
|---|---|---|---|
| Your zone | | | |
| North | | | |
| North | | | |
| South | | | |
| South | | | |

2. Your greenhouse has an overstock of jade plants and places an ad in a national gardening magazine. Orders are placed from the following locations. Shipping dates are set immediately after the spring frost-free date and 10 days before the fall freeze so there will be no risk of the plants freezing during shipping.

List the zones and the shipping dates for plants going to the destinations below.

| Destination | Zone | Spring Shipping Date | Fall Shipping date |
|---|---|---|---|
| Northern Minnesota | | | |
| Miami, Florida | | | |
| Texas Panhandle | | | |
| Northern Pennsylvania | | | |
| Central California | | | |
| Western Wyoming | | | |
| Birmingham, Alabam | | | |
| Nashville, Tennessee | | | |
| Seattle, Washington | | | |

**ASSIGNMENT SHEET 3**

## PLANT PROPAGATION

## XIV

NAME ______________________ SCORE ______

**OBJECTIVE 19**

**Determine planting and shipping dates.**

**INTRODUCTION**

Good planning is a key factor in successful greenhouse and nursery operations. The dates for seeding flats and for sending seeds and plants to market depends on the zone and the date of the last hard freeze. Fall planting, field operations, and winterizing activities are determined by the date of the first killing frost.

The dates are **averages** and should serve as guidelines rather than rules. Knowing general weather trends and conditions are part of the planning process. Because horticulture operations depend on the weather and on climate, there is always a risk involved.

**DIRECTIONS**

Use Supplements 1, 2, and 3 to determine the dates that flats should be seeded and plants should be shipped.

1. You are ordering fruit-tree stock to arrive three weeks prior to the spring frost-free date in your zone.
   a. When should plants arrive? ______________________
   b. If shipping takes 10 days, when do you place your order?
      ______________________
2. As a landscape worker, you must dig up canna bulbs at the Country Club before the first killing frost in your zone. If there are 200 bulbs and you dig 50 a day, when will you start?
   a. Date of average first frost______________________
   b. Date you start to dig ______________________

905

3. You are in zone 7. You are planning a crop of spring tomatoes to be planted outdoors in zones 6 and 8. Germination time is 8-10 days, plants are shipped 6 weeks after germination and shipped on the day of the last frost.

   EXAMPLE: Zone 4 Shipping date 5/10
   Flats should be seeded third week in March

   a. Approximate shipping date for zone 6________________

   b. Approximate date flats should be seeded for zone 6

      ________________________________

   c. Approximate shipping date for zone 8

      ________________________________

   d. Approximate date flats should be seeded for zone 8

      ________________________________

4. You are in zone 7. You are planning a crop of impatiens (*Balsaminaceae*) to be shipped to zone 5. Germination time is 3-4 weeks. Growing time is 10 weeks.

   a. Probable shipping dates. Impatiens should be planted in warm soil. They will go on the market 21 days after the average date of the last killing frost.

      Frost-free date______________

      Shipping date______________

   b. Range of dates when flats should be seeded

      ________________________________

## ASSIGNMENT SHEET 1

1. Check that zone is correctly identified.

2.

| | | | |
|---|---|---|---|
| Zone 2 | -50° to -40° | Zone 7 | 0° to 10° |
| Zone 3 | -40° to -30° | Zone 8 | 10° to 20° |
| Zone 4 | -30° to -20° | Zone 9 | 20° to 30° |
| Zone 5 | -20° to -10° | Zone 10 | 30° to 40° |
| Zone 6 | -10° to 0° | | |

3. Check that student included all zones in your state, a general description of the location, and the lowest temperatures.

4. Zone 2 in Ontario, Canada
   Lowest temperature -40°

5. Zone 10, Southern Florida, southwest Texas coast, southern California coast
   Lowest Temperature 30°

## ASSIGNMENT SHEET 2

1. Check that zone and dates are correct for your zone and for the two states north and two states south of your zone.

2.

| Destination | Zone | Spring Shipping Date | Fall Shipping date |
|---|---|---|---|
| Northern Minnesota | 3 | 5/30 | 8/30 or 9/1 |
| Miami, Florida | 10 | 1/20 | 12/1 |
| Texas Panhandle | 6 | 4/20-4/30 | 10/10-10/20 |
| Northern Pennsylvania | 5 | 5-20 | 9/20 |
| Central South Dakota | 4 | 5/10 | 9/20 |
| Birmingham, Alabama | 8 | 3/30-4/10 | 10/20-11/1 |
| Nashville, Tennessee | 7 | 3/30 | 10/20 |
| Seattle, Washington | 8 | 4/30-5/30 | 9/20 |

## ASSIGNMENT SHEET 3

NOTE: Specific dates for seeding will vary according to the calendar students use to determine the dates. Check that when specific dates are used, they fall within the range stated below.

1. a. Check that arrival date is correct for your zone.

   b. Check that order date is 10 days prior to arrival date.

2. a. Check that date of first killing frost is correct for your zone.

   b. Digging date is 4 days prior to first killing frost date.

3. a. 4/20

   b. Last week in February, first of March

   c. 3/30 or 3/20

   d. If student chose 3/30, seeding date is first week in February

      If student chose 3/20, seeding date is last week in January

4. a. Frost-free date 5/10

      Shipping date 6/1

   b. Last week in February - First week in March

**JOB SHEET 1** | **PLANT PROPAGATION** | **XIV**

**OBJECTIVE 20 a**

**Seed a flat with fine seeds.**

**TOOLS AND MATERIALS**

- Fine seeds such as petunia, periwinkle, spinach, tomato
- Flat
- Identification stake
- Stake marker

  NOTE: China marker or pencil must be used on plastic stakes.

- Porous growth medium such as 1:1:1, all vermiculite, premixed medium
- Mist nozzle or fine water breaker

**PROCEDURE**

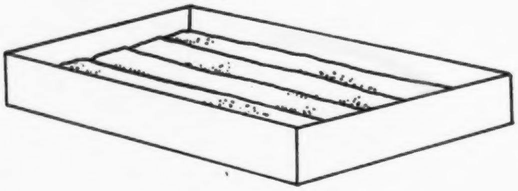
NOTE: Major seed catalogs will give temperatures, planting depth, and other important information for germination.

1. Fill the flat with plant growth medium.
2. Firm mixture slightly by patting with palm of hand.

   NOTE: Be careful not to firm the soil too much or seeds may have difficulty germinating.

3. Make shallow furrows across the flat, 2-3 times the diameter of the seed. (Figure 1)

   FIGURE 1



914

4. Sprinkle seeds into furrows; try to space seeds evenly.

5. Cover seeds very slightly with soil mixture.

   **NOTE:** Do not cover seeds the size of petunia seeds or smaller.

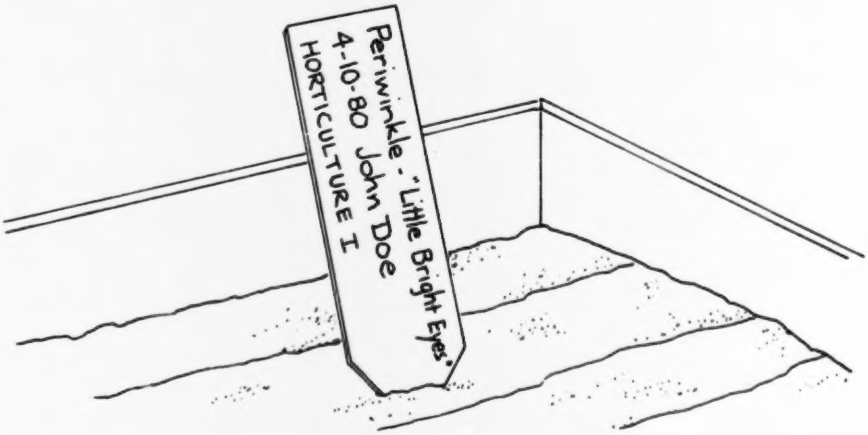
6. Gently firm soil in over seeds.

7. Water seeds in thoroughly using watering bulb or mist nozzle.

   **NOTE:** Flat may be soaked from the bottom in warm water.

8. Label the identification stake. (Figure 2)

FIGURE 2



9. Place stake in flat.

   **NOTE:** Germination may be enhanced by covering the flat with plastic; the plastic should be removed when seedlings first appear.

10. Have your instructor check your work.

11. Put away tools and materials and clean the work area.

**JOB SHEET 2**

## PLANT PROPAGATION

## XIV

**OBJECTIVE 20 b**

**Scarify seeds by file or sandpaper method.**

**TOOLS AND MATERIALS**

- Seeds with hard coat such as redbud, peach, mimosa, pecan, acorn
- Three-sided file or sandpaper
- Soil mixture or prepared soil bed

**PROCEDURE**

1. File a small notch in the seed coat or roughen side of seed with sandpaper. (Figures 1 and 2)

   NOTE: Notch should be made near the embryo without damaging the embryo tissue.

FIGURE 1

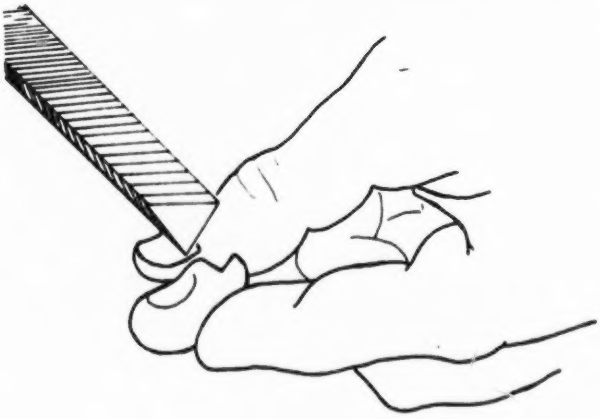
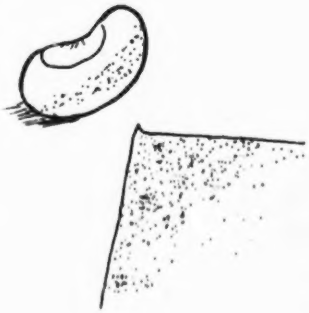


FIGURE 2



2. Plant in flat by pressing seed into soil and covering with approximately 1/4" soil mixture or plant directly outside.

**JOB SHEET 3**

## PLANT PROPAGATION

## XIV

**OBJECTIVE 20 c**

**Stratify seeds.**

**TOOLS AND MATERIALS**

- 5 pecans
- Cooler or refrigerator chilled to slightly above freezing (36-38° F., 2.2-3.3° C.)
- Peat moss
- Water
- Self-sealing plastic sandwich bag or non-self-sealing bag and rubber band
- Identification tag
- China marker
- Plastic tag

**PROCEDURE**

1. Dampen peat moss with water.
2. Place a handful of peat moss in plastic bag.
3. Place pecans in bag.
4. Seal bag either with self-sealer or with rubber band.
5. Fill out identification tag and attach to bag.
6. Place in cooler for 10 weeks.
7. Have your instructor check your work.
8. Put away tools and materials and clean the work area.

**JOB SHEET 4**

# PLANT PROPAGATION

# XIV

**OBJECTIVE 20 d**

**Propagate herbaceous stem cuttings.**

**TOOLS AND MATERIALS**

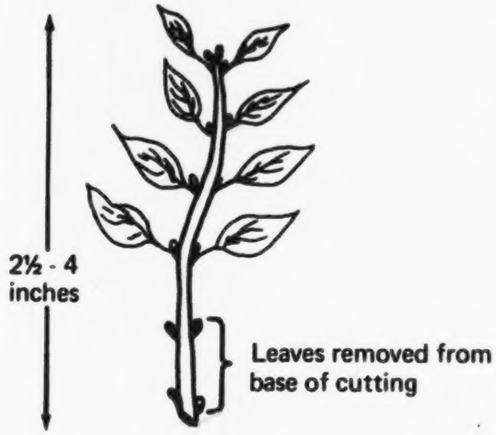
- **Plant material such as poinsettia, chrysanthemum, coleus, kalanchoe, or other indoor plants**
- **Sharp knife**
- **Plastic label**
- **6-cell pack or containers with soil or medium**
- **Dibble**
- **Rooting hormone**
- **Media**
- **China marker**
- **Mist area**

**PROCEDURE**

1. **Place media in 6-cell pack or container.**
2. **Select areas for cutting. Cutting should be between 2 1/2" and 4" long and include at least three nodes. (Figure 1)**

   **NOTE: Most cuttings should be tip cuttings. This prevents the cutting from branching.**

   **FIGURE 1**



3. Cut at an angle just below the node with a sharp, clean knife.

4. Remove lower leaves (as in Figure 1).

5. Dip stem end in tray with powdered rooting hormone.

   **CAUTION: Handle dipped plant very carefully to keep rooting hormone in place.**

   NOTE: Once hormone has been poured out, do not put it back in the container where it can contaminate the fresh powder.

6. Make hole in potting medium with dibble.

7. Place cutting in one cell of the pack or in the container.

   **CAUTION: Set root in place, loosely and carefully. If jammed or pressed into medium, plant will not root.**

8. Slightly firm cutting into place.

9. Repeat procedure to fill all 6 cells or containers.

10. Label plastic tag and place in soil.

11. Water very carefully.

12. Place under mist.

    NOTE: If mist area is not available, make a frame covered with plastic to keep plants in humid area.

13. Have your instructor check your work.

14. Put away tools and materials and clean the work area.

    NOTE: Check one cell every few days, depending on the plant, to check root development.

**OBJECTIVE 20** **Propagate a leaf cutting.**

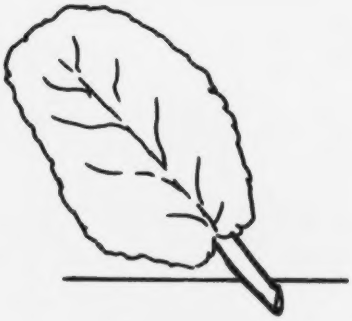
**TOOLS AND MATERIALS**

- Plant material such as African violet, rex begonia
- Sharp knife
- Rooting hormone
- Dibble
- 6-cell pack or container with soil medium
- Label
- China marker
- Mist area
- Media

**PROCEDURE**

1. Select healthy leaves for cuttings.
2. Place soil in pack.
3. Make a slated cut at the base of the petiole. (Figure 1)

FIGURE 1



4. Dip stem end into rooting hormone.

   **CAUTION: Handle dipped plant very carefully to keep roofing hormone in place.**

5. Make a hole in the soil medium with a dibble.

6. Place cuttings in pack or container.

   **CAUTION: Set root in place loosely and carefully. If jammed or pressed into medium, the plant will not root.**

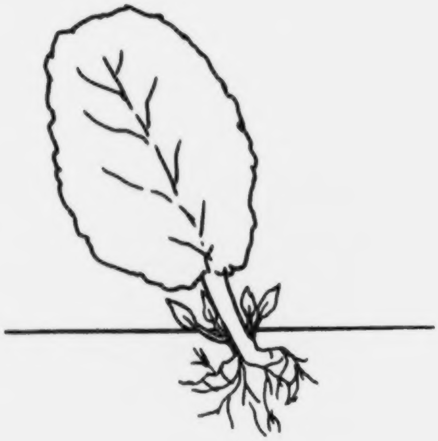
7. Label pack or container.

8. Water cuttings in carefully.

9. Place cuttings under mist.

10. Transplant when cuttings are rooted; plantlets will develop from the petiole. (Figure 2)

    FIGURE 2



11. Have your instructor check your work.

12. Put away tools and materials and clean the work area.

921

**OBJECTIVE 20f** **Air layer plants.**

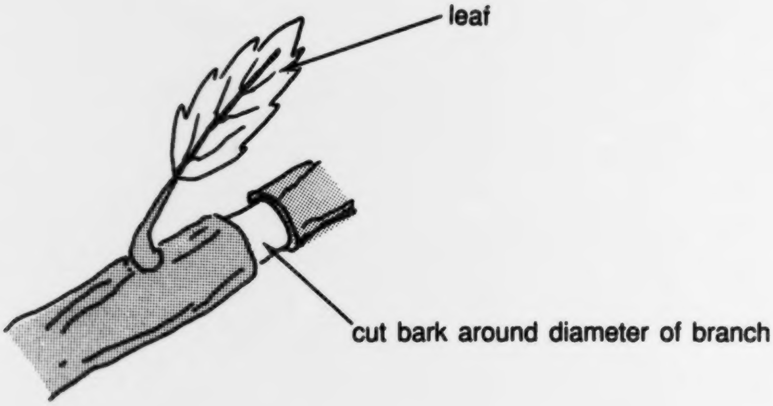
**TOOLS AND MATERIALS**

- Plant material with large central stems such as diffenbachia, Chinese evergreen, dracaena, rubber tree
- Moist sphagnum moss
- Sharp double-blade budding knife
- Rooting hormone
- Air-layer poly or plastic wrap
- String

**PROCEDURE**

1. Carefully cut around stem with double-blade budding knife to remove a section 3/4", through outer layer of stem and cambium layers. (Figure 1)

FIGURE 1



2. Remove outer layer of stem.
3. Apply rooting hormone into wound.

922

4. Pack moist sphagnum moss around the wound.

   **NOTE:** Squeeze extra moisture out of the sphagnum moss. If area is too wet, it will rot.

5. Wrap poly around moss and wound area.

6. Tie off poly top and bottom so it is airtight.

7. After rooting has occurred, cut off **under** rooted area and pot.

   **NOTE:** Air layering usually takes from four to six weeks for good root development.

8. Have your instructor check your work.

9. Put away tools and materials and clean the work area.

**JOB SHEET 7**

## PLANT PROPAGATION

## XIV

**OBJECTIVE 20g**

**Propagate hardwood cuttings.**

**TOOLS AND MATERIALS**

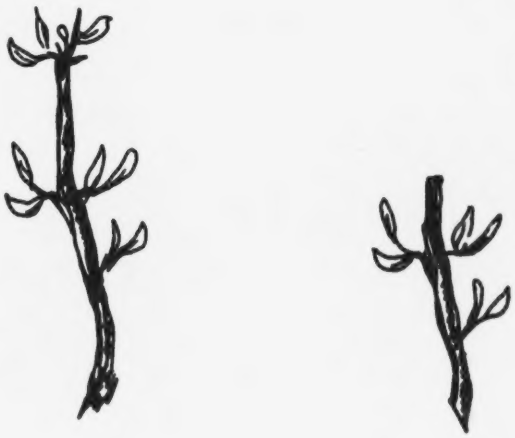
- Plant material such as willow, crape myrtle, honeysuckle, wisteria, pyracantha, azalea
- Sharp knife or shears
- Plastic label
- China marker
- Soil medium
- Container such as 6-cell pack, flat, individual pots, or prepared garden soil

**PROCEDURE**

1. Place soil in container.
2. Select stems for cutting.
3. Make cuttings 4-12 inches long, including at least 2 nodes.

   **NOTE:** Polarity is important. To prevent mistakes, cut the top of the cutting flat across and the base of the cutting at a slant as in Figure 1.

FIGURE 1



4. Place cutting in soil and firm in.
5. Water cutting in carefully.
6. Label cutting.
7. Have your instructor check your work.
8. Put away tools and materials and clean the work area.

JOB SHEET 8

## PLANT PROPAGATION

XIV

**OBJECTIVE 20h**

**Bud by t-bud method.**

**TOOLS AND MATERIALS**

- Budstick 1/4" to 1" in diameter
- Rootstock 1/4" to 1" in diameter

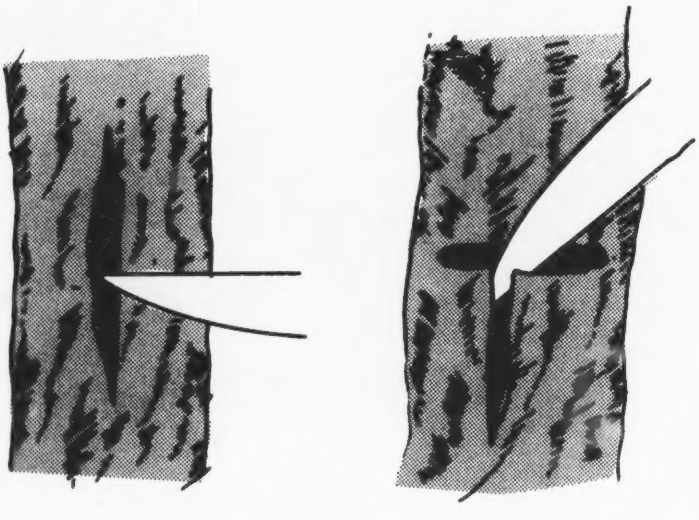
  NOTE: Rootstock and bud wood must be comparable plants, such as walnut and pecan or different varieties of the same plant.
- Sharp knife
- Plastic grafting tape or budding rubbers
- Tag

**PROCEDURE**

1. Select bud wood with bark slipping and of proper size.
2. Select rootstock with bark slipping and of proper size.
3. Make the "T" incision on the rootstock, through the bark. (Figure 1)
   a. Make vertical cut 1" long.
   b. Make horizontal cut 1/3 distance around stock.

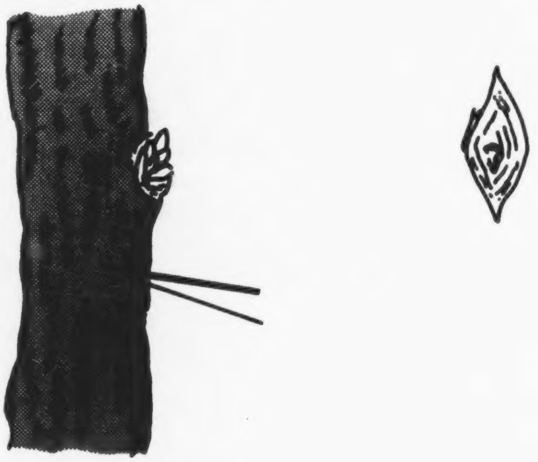
   NOTE: Twist knife slightly to open the flaps.

FIGURE 1



4. Prepare bud—Make incision beginning 1/2" below selected bud and ending 1" above bud. (Figure 2)

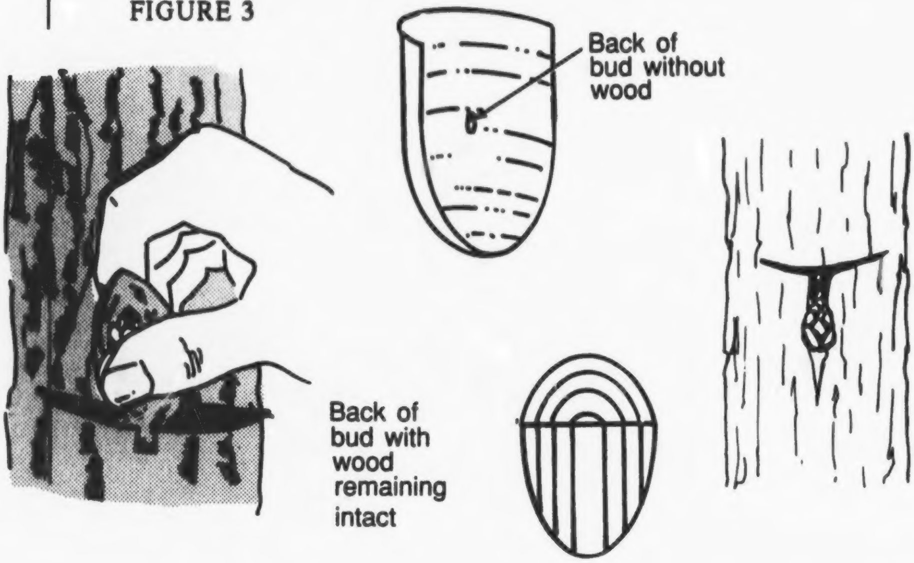
FIGURE 2



5. Place bud in the T incision by pushing bud downward under the two flaps of bark until bud is completely inserted. (Figure 3)

**NOTE:** The wood may or may not be removed from inside the bud. If the wood is removed, the center of the bud containing the vascular system **must** be intact or bud will not grow. Remove wood very carefully.

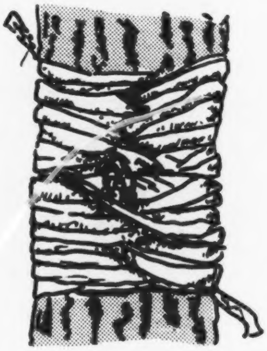
FIGURE 3


Back of bud without wood
Back of bud with wood remaining intact

6. Tie bud in place with either grafting tape or budding rubbers. (Figure 4)

   **CAUTION:** Do not cover the bud when tying into place or growth will not take place.

   FIGURE 4



7. Label bud location.
8. Have your instructor check your work.
9. Put away tools and materials and clean the work area.

**JOB SHEET 9**

# PLANT PROPAGATION XIV

**OBJECTIVE 201**

**Bud by patch method.**

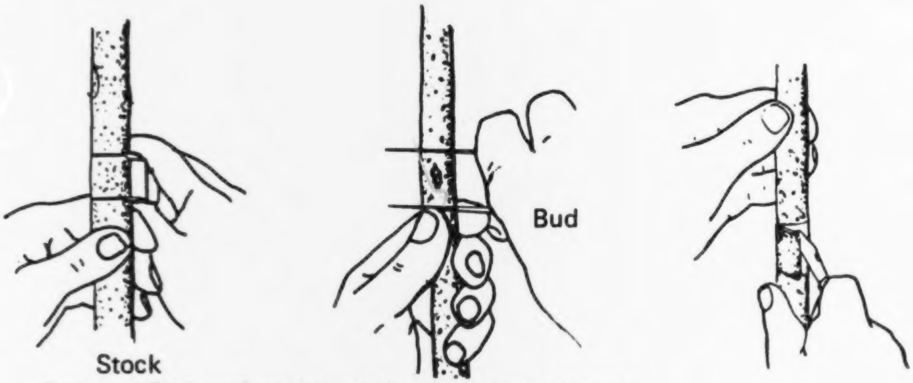
**TOOLS AND MATERIALS**

- Budstick 1/4" to 1" in diameter
- Rootstock 1/4" to 1" in diameter
- Cutting tool such as double blade knife, single blade knife, adjustable razors, patcher tool
- Plastic grafting tape or budding rubbers
- Label or tag

**PROCEDURE**

1. Select proper rootstock.
2. Select proper budstick.
3. Make incisions on rootstock using single or double blade knife. (Figure 1)

FIGURE 1

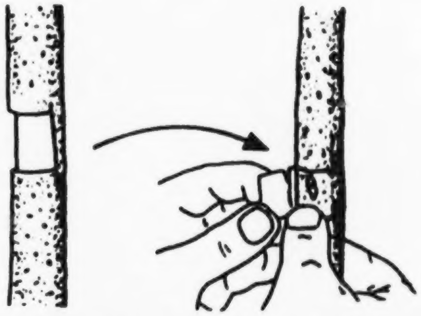


Courtesy of Oklahoma State University Cooperative Extension Service

4. Make identical cuts on budstick.
5. Transfer the bud into the stock. (Figure 2)

**NOTE:** Do not remove bark patch from stock until ready to insert bud or bud may dry out.

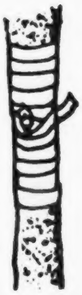
FIGURE 2



Courtesy of Oklahoma State University Cooperative Extension Service

6. Tie bud in place, being careful not to cover the bud. (Figure 3)

FIGURE 3



Courtesy of Oklahoma State University Cooperative Extension Service

7. Label the bud location.
8. Have your instructor check your work.
9. Put away tools and materials and clean the work area.

**JOB SHEET 10**

## PLANT PROPAGATION

## XIV

**OBJECTIVE 20j**

**Graft by whip and tongue method.**

**TOOLS AND MATERIALS**

- Scion 1/4" to 1/2" in diameter
- Stock 1/4" to 1/2" in diameter
- Very sharp knife
- Grafting wax
- Grafting string
- Label or tag

**PROCEDURE**

1. Make smooth sloping cut on top end of stock 1" to 2 1/2" long. (Figure 1)
2. Make smooth sloping cut on basal end of scion to match cut on stock. (Figure 2)

FIGURE 1

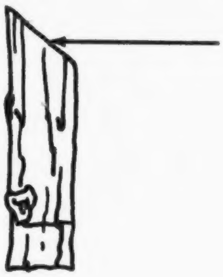
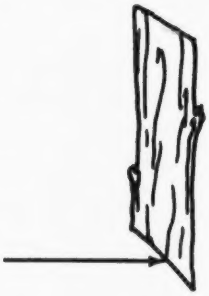
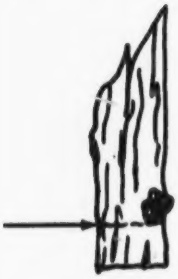


FIGURE 2



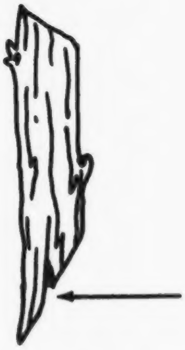
3. Make a second cut on the stock 1/3 of the distance from tip to base of first cut. (Figure 3)

FIGURE 3



4. Make a similar cut on the scion. (Figure 4)

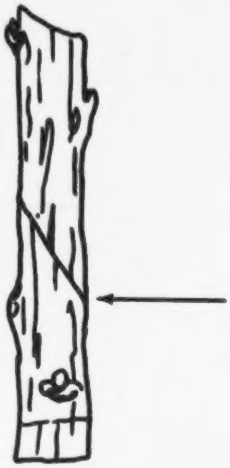
FIGURE 4



5. Slip the two cut surfaces together and interlock. (Figure 5)

**NOTE:** The cambium of the two pieces must be in complete contact for growth to occur.

FIGURE 5

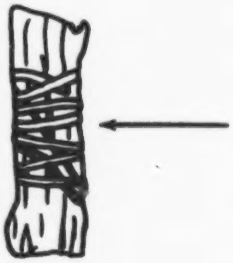


6. Tie and wax graft by coating tied area with soft grafting wax. (Figure 6)

   **NOTE:** If graft is bedded in peat, waxing is not needed.

   **EXAMPLE:** Grapes

FIGURE 6



7. Label graft.
8. Have your instructor check your work.
9. Put away tools and materials and clean the work area.

## JOB SHEET 11 — PLANT PROPAGATION — XIV

**OBJECTIVE 20 k**

**Graft by bark graft method.**

**TOOLS AND MATERIALS**

- Stock 1" to 2"
- 2 or 3 scions 1/4" to 1/2" long with 2 or 3 buds, 4" to 5" long

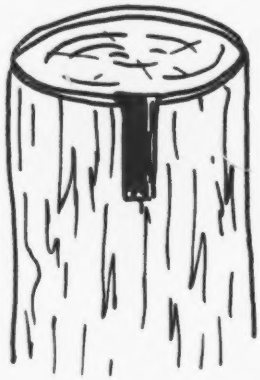
  NOTE: Scions should be dormant; store in cooler in moist peat until needed.
- Sharp knife
- Saw
- Tinfoil
- Flatheaded nails, 5/8" to 1" long, or 19 or 10 gauge wire brads

**PROCEDURE**

1. Saw off stock to desired graft location.
2. Make two parallel, vertical cuts 1" to 2" long through bark.

   NOTE: Width of cuts should be same as scion width.
3. Make 1 or 2 more cuts, depending on size of the stock.
4. Remove most of the bark flap. (Figure 1)

FIGURE 1

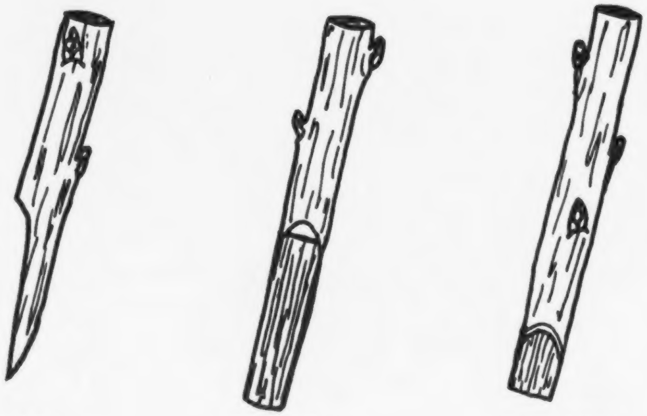


5. Prepare scion. (Figure 2)

   a. Make a long, sloping cut on basal end of scion.

   b. Make shorter cut on opposite side.

FIGURE 2



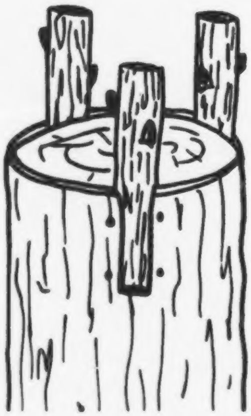
Side View Back View Front View

6. Insert scion into stock. (Figure 3)

   a. Slide end of scion under flap portion.

   b. Nail scion into place with flatheaded nails or brads.

FIGURE 3



7. Repeat above procedure for additional scions.
8. Cover stub with tinfoil, leaving tops of scions exposed.
9. Have your instructor check your work.
10. Put away tools and materials and clean the work area.

**PRACTICAL TEST 1**

## PLANT PROPAGATION

## XIV

**JOB SHEET 1**

**Seed a flat with fine seeds.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Filled the flat with plant growth medium. | ____ | ____ |
| 2. Firmed mixture slightly by patting with palm of hand. | ____ | ____ |
| 3. Made shallow furrows across the flat, 2-3 times the diameter of the seed. | ____ | ____ |
| 4. Sprinkled seeds into furrows; tried to space seeds evenly. | ____ | ____ |
| 5. Covered seeds very slightly with soil mixture. | ____ | ____ |
| 6. Gently firmed soil in over seeds. | ____ | ____ |
| 7. Watered seeds in thoroughly using fine breaker or mist nozzle. | ____ | ____ |
| 8. Labeled the identification stake. | ____ | ____ |
| 9. Placed stake in flat. | ____ | ____ |
| 10. Used proper tools correctly. | ____ | ____ |
| 11. Performed steps in a timely manner. | ____ | ____ |
| 12. Practiced safety rules throughout procedure. | ____ | ____ |
| 13. Provided satisfactory responses to questions asked. | ____ | ____ |
| 14. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Firmed soil | 4 | 3 | 2 | 1 |
| Made shallow furrows | 4 | 3 | 2 | 1 |
| Seeded flat | 4 | 3 | 2 | 1 |
| Watered in thoroughly | 4 | 3 | 2 | 1 |
| Labeled identification stake | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key."

## PERFORMANCE EVALUATION KEY

- 4 - Skilled—Can perform job with no additional training
- 3 - Moderately skilled—Has performed job during training program, limited additional training may be required
- 2 - Limited skill—Has performed job during training program; additional training is required to develop skill
- 1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 2**

## PLANT PROPAGATION

# XIV

**JOB SHEET 2**

**Scarify seeds by file or sandpaper method.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Filed a small notch in the seed coat or roughened side of seed with sandpaper. | ____ | ____ |
| 2. Planted seed in flat by pressing seed into soil and covering with approximately 1/4" soil mixture, or planted directly outside. | ____ | ____ |
| 3. Used proper tools correctly. | ____ | ____ |
| 4. Performed steps in a timely manner. | ____ | ____ |
| 5. Practiced safety rules throughout procedure. | ____ | ____ |
| 6. Provided satisfactory responses to questions asked. | ____ | ____ |
| 7. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

____________________________________________

____________________________________________

____________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Scarified seed | | | | |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

## PRACTICAL TEST 3 — PLANT PROPAGATION — XIV

### JOB SHEET 3

**Stratify seeds.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

### PROCESS EVALUATION

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Dampened peat moss with water. | ____ | ____ |
| 2. Placed a handful of peat moss in plastic bag. | ____ | ____ |
| 3. Placed pecans in bag. | ____ | ____ |
| 4. Sealed bag either with self-sealer or with rubber band. | ____ | ____ |
| 5. Filled out identification tag and attached it to bag. | ____ | ____ |
| 6. Placed in cooler for 10 weeks. | ____ | ____ |
| 7. Used proper tools correctly. | ____ | ____ |
| 8. Performed steps in a timely manner. | ____ | ____ |
| 9. Practiced safety rules throughout procedure. | ____ | ____ |
| 10. Provided satisfactory responses to questions asked. | ____ | ____ |
| 11. Put away tools and cleaned work area. | ____ | ____ |

### EVALUATOR'S COMMENTS

______________________________________________

______________________________________________

______________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Stratified seeds | | | | |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 4** | **PLANT PROPAGATION** | **XIV**

**JOB SHEET 4**

**Propagate herbaceous stem cuttings.**

Student's name ______________________ Date ________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Placed media in 6-cell pack or container. | ____ | ____ |
| 2. Selected areas for cutting: between 2 1/2" and 4" long and including at least three nodes. | ____ | ____ |
| 3. Cut at an angle just below the node with a sharp, clean knife. | ____ | ____ |
| 4. Removed lower leaves. | ____ | ____ |
| 5. Dipped stem end in tray with powdered rooting hormone. | ____ | ____ |
| 6. Placed cutting in one cell of the pack or in the container. | ____ | ____ |
| 7. Slightly firmed cutting into place. | ____ | ____ |
| 8. Repeated procedure to fill all 6 cells or containers. | ____ | ____ |
| 9. Labeled plastic tag and placed in soil. | ____ | ____ |
| 10. Watered very carefully. | ____ | ____ |
| 11. Placed under mist. | ____ | ____ |
| 12. Used proper tools correctly. | ____ | ____ |
| 13. Performed steps in a timely manner. | ____ | ____ |
| 14. Practiced safety rules throughout procedure. | ____ | ____ |
| 15. Provided satisfactory responses to questions asked. | ____ | ____ |
| 16. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Took cutting | | | | |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 5**

## PLANT PROPAGATION

**JOB SHEET 5**

**Propagate a leaf cutting.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected healthy leaves for cuttings. | ____ | ____ |
| 2. Placed soil in pack. | ____ | ____ |
| 3. Made a slated cut at the base of the petiole. | ____ | ____ |
| 4. Dipped stem end into rooting hormone. | ____ | ____ |
| 5. Placed cuttings in pack or container. | ____ | ____ |
| 6. Labeled pack or container. | ____ | ____ |
| 7. Watered cuttings in carefully. | ____ | ____ |
| 8. Placed cuttings under mist. | ____ | ____ |
| 9. Transplanted when cuttings are rooted. | ____ | ____ |
| 10. Used proper tools correctly. | ____ | ____ |
| 11. Performed steps in a timely manner. | ____ | ____ |
| 12. Practiced safety rules throughout procedure. | ____ | ____ |
| 13. Provided satisfactory responses to questions asked. | ____ | ____ |
| 14. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| | 4 | 3 | 2 | 1 |
| Selected leaves | | | | |
| | 4 | 3 | 2 | 1 |
| Cut leaves | | | | |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 6**

## PLANT PROPAGATION

# XIV

**JOB SHEET 6**

**Air layer plants.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ______

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Carefully cut around stem with double-blade budding knife to remove a section 3/4", through outer layer of stem and cambium layers. | ____ | ____ |
| 2. Removed outer layer of stem. | ____ | ____ |
| 3. Applied rooting hormone into wound. | ____ | ____ |
| 4. Packed moist sphagnum moss around the wound. | ____ | ____ |
| 5. Wrapped poly around moss and wound area. | ____ | ____ |
| 6. Tied off poly top and bottom so it was airtight. | ____ | ____ |
| 7. After rooting occurred, cut off under rooted area and potted. | ____ | ____ |
| 8. Used proper tools correctly. | ____ | ____ |
| 9. Performed steps in a timely manner. | ____ | ____ |
| 10. Practiced safety rules throughout procedure. | ____ | ____ |
| 11. Provided satisfactory responses to questions asked. | ____ | ____ |
| 12. Put away tools and cleaned work area. | ____ | ____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Made cut | 4 | 3 | 2 | 1 |
| Placed moss | 4 | 3 | 2 | 1 |
| Sealed poly | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 7**

## PLANT PROPAGATION

# XIV

**JOB SHEET 7**

**Propagate hardwood cuttings.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Placed soil in container. | _____ | _____ |
| 2. Selected stems for cutting. | _____ | _____ |
| 3. Made cuttings 4-12 inches long, including at least 2 nodes. | _____ | _____ |
| 4. Placed cutting in soil and firm in. | _____ | _____ |
| 5. Watered cutting in carefully. | _____ | _____ |
| 6. Labeled cutting. | _____ | _____ |
| 7. Used proper tools correctly. | _____ | _____ |
| 8. Performed steps in a timely manner. | _____ | _____ |
| 9. Practiced safety rules throughout procedure. | _____ | _____ |
| 10. Provided satisfactory responses to questions asked. | _____ | _____ |
| 11. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| Took cuttings | | | | |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 8**

## PLANT PROPAGATION

## XIV

**JOB SHEET 8**

**Bud by t-bud method.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected bud wood with bark slipping and of proper size. | _____ | _____ |
| 2. Selected rootstock with bark slipping and of proper size. | _____ | _____ |
| 3. Made the "T"-incision on the rootstock, through the bark. | | |
| a. Made vertical cut 1" long. | _____ | _____ |
| b. Made horizontal cut 1/3 distance around stock. | _____ | _____ |
| 4. Prepared bud—Made incision beginning 1/2" below selected bud and ending 1" above bud. | _____ | _____ |
| 5. Placed bud in the T-incision by pushing bud downward under the two flaps of bark until bud was completely inserted. | _____ | _____ |
| 6. Tied bud in place with either grafting tape or budding rubbers. | _____ | _____ |
| 7. Labeled bud location. | _____ | _____ |
| 8. Used proper tools correctly. | _____ | _____ |
| 9. Performed steps in a timely manner. | _____ | _____ |
| 10. Practiced safety rules throughout procedure. | _____ | _____ |
| 11. Provided satisfactory responses to questions asked. | _____ | _____ |

The student: YES NO

12. Put away tools and cleaned work area. ____ ____

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Made "T" incision | 4 | 3 | 2 | 1 |
| Prepared bud | 4 | 3 | 2 | 1 |
| Placed bud incision | 4 | 3 | 2 | 1 |
| Tied bud in place | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key."

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 9**

# PLANT PROPAGATION

# XIV

**JOB SHEET 9**

**Bud by patch method.**

Student's name ____________________________ Date ___________

Evaluator's name ___________________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected proper rootstock. | _____ | _____ |
| 2. Selected proper budstick. | _____ | _____ |
| 3. Made incisions on rootstock using single or double blade knife. | _____ | _____ |
| 4. Made identical cuts on budstick. | _____ | _____ |
| 5. Transferred the bud into the stock. | _____ | _____ |
| 6. Tied bud in place, being careful not to cover the bud. | _____ | _____ |
| 7. Labeled the bud location. | _____ | _____ |
| 8. Used proper tools correctly. | _____ | _____ |
| 9. Performed steps in a timely manner. | _____ | _____ |
| 10. Practiced safety rules throughout procedure. | _____ | _____ |
| 11. Provided satisfactory responses to questions asked. | _____ | _____ |
| 12. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Cut rootstock | 4 | 3 | 2 | 1 |
| Cut budstick | 4 | 3 | 2 | 1 |
| Transferred budstick to stock | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 10**

## PLANT PROPAGATION

# XIV

**JOB SHEET 10**

**Graft by whip and tongue method.**

Student's name ______________________________ Date ___________

Evaluator's name ___________________________ Attempt no._____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Made smooth sloping cut on top end of stock 1" to 2 1/2" long. | ______ | ______ |
| 2. Made smooth sloping cut on basal end of scion to match cut on stock. | ______ | ______ |
| 3. Made a second cut on the stock 1/3 of the distance from tip to base of first cut. | ______ | ______ |
| 4. Made a similar cut on the scion. | ______ | ______ |
| 5. Slipped the two cut surfaces together and interlocked. | ______ | ______ |
| 6. Tied and waxed graft by coating tied area with soft grafting wax. | ______ | ______ |
| 7. Labeled graft. | ______ | ______ |
| 8. Used proper tools correctly. | ______ | ______ |
| 9. Performed steps in a timely manner. | ______ | ______ |
| 10. Practiced safety rules throughout procedure. | ______ | ______ |
| 11. Provided satisfactory responses to questions asked. | ______ | ______ |
| 12. Put away tools and cleaned work area. | ______ | ______ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Cut on top end of stock | 4 | 3 | 2 | 1 |
| Cut on basal end of stock | 4 | 3 | 2 | 1 |
| Interlocked surfaces | 4 | 3 | 2 | 1 |
| Tied and waxed graft | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**PRACTICAL TEST 11**

# PLANT PROPAGATION

# XIV

**JOB SHEET 11**

**Graft by bark graft method.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Sawed off stock to desired graft location. | _____ | _____ |
| 2. Made two parallel, vertical cuts 1" to 2" long through bark. | _____ | _____ |
| 3. Made 1 or 2 more cuts, depending on size of the stock. | _____ | _____ |
| 4. Removed most of the bark flap. | _____ | _____ |
| 5. Prepared scion. | | |
| a. Made a long, sloping cut on basal end of scion. | _____ | _____ |
| b. Made shorter cut on opposite side. | _____ | _____ |
| 6. Inserted scion into stock. | | |
| a. Slid end of scion under flap portion. | _____ | _____ |
| b. Nailed scion into place with flatheaded nails or brads. | _____ | _____ |
| 7. Repeated above procedure for additional scions. | _____ | _____ |
| 8. Covered stub with tinfoil, leaving tops of scions exposed. | _____ | _____ |
| 9. Used proper tools correctly. | _____ | _____ |
| 10. Performed steps in a timely manner. | _____ | _____ |
| 11. Practiced safety rules throughout procedure. | _____ | _____ |
| 12. Provided satisfactory responses to questions asked. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 13. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Made cuts | 4 | 3 | 2 | 1 |
| Prepared scion | 4 | 3 | 2 | 1 |
| Inserted scion into stock | 4 | 3 | 2 | 1 |
| Covered stub | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program, limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

## PLANT PROPAGATION XIV

**OBJECTIVE 1**

**Match terms associated with plant propagation to their correct definitions.** Write the correct letters in the blanks.

__ 1. Climate areas defined by lowest temperatures

__ 2. Method of attaching twigs, buds, or roots onto other stems or roots so that tissues are joined; and a new plant results

__ 3. Non-woody; type of plants grown in greenhouse operations

__ 4. Current year's growth on a hardwood plant at the end of the growing season

__ 5. Non-stick plastic tape used to hold buds and grafts in place, and to prevent drying

__ 6. Used to seal grafts

__ 7. Tendency for a cutting to sprout roots from the bottom end and sprout shoots from the top

__ 8. Reproduction using cuttings from leaves, stems, or roots to make new plants

__ 9. Plant that develops a woody stem

__ 10. Reproduction involving female (egg) and male (pollen) sex cells producing seed; seeds make new plants

a. Grafting tape  
b. Hardiness zones  
c. Sexual propagation  
d. Softwood  
e. Semi-softwood  
f. Hardwood  
g. Semi-hardwood  
h. Grafting wax  
i. Scarification  
j. Asexual propagation  
k. Grafting  
l. Stratification  
m. Herbaceous  
n. Polarity  
o. Budding tape

___11. Portion of the plant attached to rootstock or another twig during grafting

___12. Special type of grafting where a single bud is used as a scion

___13. Twig used as a source of buds when budding

___14. Narrow strips of rubber used to tie grafts and buds in place and prevent drying

___15. To cut a section of bark and cambium completely around a stem

___16. Able to live

___17. Seed begins to grow

___18. A narrow groove made in the soil

___19. Rest period required for some seeds to germinate; naturally occurs in late fall and winter

___20. Plant that retains its leaves all year

___21. Plant that receives a graft or bud

p. Rootstock
q. Viable
r. Seed bed
s. Germination
t. Embryo
u. Scioning
v. Budstick
w. Rootstick
x. Evergreen
y. Plumule
z. Budding
aa. Furrow
bb. Scion
cc. Dormancy
dd. Radicle
ee. Girdle
ff. Budding rubbers

**OBJECTIVE 2**

**Distinguish between reasons for using sexual or asexual propagation methods.** Write an "S" in the blank before statements referring to sexual propagation methods and an "A" in the blank before statements referring to asexual propagation methods. Write "SA" if the statement refers to both methods.

____1. Growers can produce new and better plants by careful breeding

____2. Larger plants can be grown faster

____3. New plants are identical to parent plants

____4. Some plants do not have seeds

____5. Some plants are easier and cheaper to propagate

___ 6. Grafting and budding onto rootstocks can give plants the ability to resist disease or other damage

___ 7. Some plants can reproduce only by seed

**OBJECTIVE 3**

**Name parts of a seedling.** Write the correct answer in the blanks.

1. ________________________First leaves to appear on a plant

2. ________________First root to emerge

3. ________________Outer layer of the seed

4. ________________Shoot or seed bud that emerges from the soil or growing medium

**OBJECTIVE 4**

**Arrange in order the steps in germination.** Write a "1" in the blank before the first step, a "2" in the blank before the second step, etc.

___ 1. Seed coat splits open

___ 2. Cotyledons dry and fall off; the plant develops leaves and a root system and continues to grow

___ 3. The radicle grows downward

___ 4. First true leaves open

___ 5. Seed coat softens and swells

___ 6. The shoot grows upward

___ 7. Seed soaks up water

___ 8. The cotyledons open from the shoot

**OBJECTIVE 5** **Describe factors that affect germination.**

1. Properly prepared seedbed ______________________________
______________________________
2. Temperature ______________________________
______________________________
3. Moisture ______________________________
______________________________
4. Darkness or light ______________________________
______________________________
5. Air ______________________________
______________________________
6. Depth of planting ______________________________
______________________________
7. Winter freezing ______________________________
______________________________

**OBJECTIVE 6** **Name methods of seeding.** Write the correct answer in the blank.

1. ______________________________

Used for small- and medium-sized seeds; in garden areas furrows are made with a hoe; in the greenhouse they are made with a finger or a small tool; used for (1) seeding flats filled with soilless medium, and (2) direct seeding in soil and in soil-filled benches.

2. ______________________________

Used for medium-large and large seeds; the seeds are placed in soil or medium by hand. Bedding plants are often seeded with this method to avoid transplanting later.

3. ______________________________

Used in large commercial operations for specialized growing.

**OBJECTIVE 7** **List types of seeds available.**

**OBJECTIVE 8** **Define methods of speeding germination.**

Scarification—

Stratification—

**OBJECTIVE 9** **Define scarification techniques.**

Acid treatment—______________________________

File or sandpaper technique—______________________________

Soaking—______________________________

**OBJECTIVE 10**

**Match factors affecting successful asexual propagation to their correct definitions.** Write the correct letters in the blanks.

___ 1. Should be a sterile mix, free from disease or pests, that provides proper drainage and aeration

___ 2. Should meet exposure requirement for the specific plant

___ 3. Must be artificially provided to insure propagation will occur

___ 4. Misting systems should keep plants from drying out

___ 5. Must be adequate to prevent drying

___ 6. Cutting should be taken just below a node because hormones build up at the nodes and new roots form there

___ 7. Should be within the proper range for propagation to occur for the specific plant

___ 8. Automatic intermittent heat and misting systems

___ 9. Different types of cuttings are taken at different times of year for best rooting results

___ 10. Cutting should have enough food to last until roots have formed

___ 11. Cuttings generally should be taken from new growth

a. Number of cuttings made at the same time

b. Proper equipment

c. Position of cutting

d. Type of container

e. Dormancy period

f. Age of cutting

g. Fertilizer

h. Temperature

i. Moisture

j. Dry heat

k. Light

l. Bottom heat

m. Humidity

n. Media

o. Sterility of water

p. Health of plant

q. Type of misting system

r. Time of cutting

s. Plant species

**OBJECTIVE 11**

**Match types of asexual propagation for greenhouse operations to their correct descriptions.** Write the correct letters in the blanks.

____1. Include leaf and petiole; plantlet grows from base of petiole

____2. Plants may spread by above-ground stems; bulbs form bulblets attached to side of bulb

____3. Most common method for indoor plants; should include at least 3 nodes per cutting; tip cuttings are preferred over stems which have been cut before to prevent a branched plant

____4. Plants are rooted while still attached to parent plant

____5. Plants are spread by underground roots or stems

____6. Must include a bud at a node for a plant to develop

____7. Parts are bundled and stored at 40° F for 3 weeks; cuttings are planted 2-3 inches apart in final location

a. Scioning

b. Stem cuttings

c. Layering

d. Division

e. Isolated cuttings

f. Root cuttings

g. Leaf cuttings

h. Compacting

i. Leaf-bud cuttings

j. Separation

**OBJECTIVE 12**

**Match types of asexual propagation methods for nursery operations to their correct descriptions.** Write the correct letters in the blanks.

____1. Bud is attached to stock plant by various means to produce a more desirable plant

____2. Scion is attached to stock plant by various means to produce a more desirable plant

a. Grafting

b. Scioning

c. Budding

d. Rootstocking

**OBJECTIVE 13**

**Match types of stem cuttings to the proper season for taking cuttings.** Write the correct letters in the blanks. Some blanks require more than one letter.

___ 1. Taken from new growth in the fall or from old growth in the winter

___ 2. Can be taken at any time

___ 3. Taken in the fall or early winter

a. Shrubs

b. Semi-hardwood

c. Narrowleaf evergreens

d. Hardwood

e. Herbaceous

f. Softwood

g. Broadleaf evergreens

**OBJECTIVE 14**

**Match types of layering to their correct definitions.** Write the letters in the blanks.

___ 1. The mother plant is bent to the ground and buried; shoots arise from the buds and roots form underground; shoot is cut off and replanted

___ 2. A stem is pulled to the ground, wounded near the outside end of the stem, and buried at the wound

___ 3. Part of the plant is girdled or slit and then packed in a moist growing medium such as sphagnum moss and wrapped in plastic; roots form where the plant has been wounded

___ 4. Mother plant is cut to soil level and the stem is covered with soil. As shoots appear, more soil is added; shoots are cut free and planted in early spring

a. Mound layering

b. Node layering

c. Stem or air layering

d. Root layering

e. Trench layering

f. Leaf layering

g. Tip layering

h. Basal layering

**OBJECTIVE 15**

**Name types of budding methods used in nursery operations.** Write the answers in the blanks.

1. ____________________Transfer of bud and bark only, no wood included; one of the easiest methods

2. ____________________Must include the wood behind the bud; difficult to fit size of bud to stock

3. ____________________May or may not include wood behind the bud

**OBJECTIVE 16**

**Distinguish among types of grafts used in nursery production.** Write "WT" in the blank before statements describing whip and tongue grafts. Write "B" in the blanks before statements describing bark grafts. Write "A" in the blanks before statements describing approach grafts. Write "FF" in the blanks before statements describing four-flap or banana grafts.

____1. Scion is inserted under the bark; extremely easy method

____2. Four vertical cuts on the stock

____3. Used for hardwood cuttings, roots, and rootstock scion grafts; fairly simple method; can be done any time

____4. Used any time the plant is active; very easy method

____5. V-shaped wound is susceptible to disease and insect problems

____6. Must be done when bark is slipping on the stock; scion must be dormant

____7. Used to propagate plants that are difficult to root or that do not have viable seed; can be done on herbaceous and woody materials

| | | |
|---|---|---|
| **NOTICE** | The following assignment sheets and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor. | |
| **OBJECTIVE 17** | **Identify hardiness zones.** | SCORE _______ |
| **OBJECTIVE 18** | **Create zone and frost-date charts.** | SCORE _______ |
| **OBJECTIVE 19** | **Determine planting and shipping dates.** | SCORE _______ |
| **OBJECTIVE 20** | **Demonstrate the ability to** | |
| | **a. Seed a flat with fine seeds** | RATING ______ |
| | **b. Scarify seeds by file or sandpaper method** | RATING ______ |
| | **c. Stratify seeds** | RATING ______ |
| | **d. Propagate herbaceous stem cuttings** | RATING ______ |
| | **e. Propagate a leaf cutting** | RATING ______ |
| | **f. Air layer plants** | RATING ______ |
| | **g. Propagate hardwood cuttings** | RATING ______ |
| | **h. Bud by t-bud method** | RATING ______ |
| | **i. Bud by patch method** | RATING ______ |
| | **j. Graft by whip and tongue method** | RATING ______ |
| | **k. Graft by bark graft method** | RATING ______ |

## WRITTEN TEST ANSWERS

## PLANT PROPAGATION XIV

**OBJECTIVE 1**

1. b
2. k
3. m
4. g
5. a
6. h
7. n
8. j
9. f
10. c
11. bb
12. z
13. v
14. ff
15. ee
16. q
17. s
18. aa
19. cc
20. x
21. p

**OBJECTIVE 2**

1. S
2. A
3. A
4. A
5. SA
6. A
7. S

**OBJECTIVE 3**

1. Cotyledons
2. Radicle
3. Seed coat
4. Plumule

**OBJECTIVE 4**

1. 3
2. 8
3. 4
4. 7
5. 2
6. 5
7. 1
8. 6

**OBJECTIVE 5**

1. Soil or medium should provide drainage and aeration
2. Should be controlled according to seed requirements
3. Must be carefully watched so seeds are neither too wet nor too dry for the particular seed
4. Exposure must meet seed requirements
5. Proper circulation is needed for germination
6. Usually 2 to 3 times the diameter of the seed. Very small seeds are sown on the surface
7. Some seeds must live in the frozen ground before germinating

**OBJECTIVE 6**

1. Furrow
2. Individual seed
3. Automated equipment

**OBJECTIVE 7**

- Bulk or loose pack
- Pelleted
- Seed tape

**OBJECTIVE 8**

- Scarification—Altering the seed coat to allow water penetration into the seed so that the seed can grow faster. Scarification breaks the tough seed coat, increases germination rate, and increases water absorption
- Stratification—Cold treatment given to some types of seed to complete ripening and overcome dormancy. Plants are placed in a moist environment in temperatures just above freezing

**OBJECTIVE 9**

- Acid treatment—Seeds are placed in sulfuric acid solution for a certain length of time to help soften the seed coat
- File or sandpaper technique—Seed coat is notched by filing a small indentation
- Soaking—Seeds are soaked overnight in water

**OBJECTIVE 10**

1. n
2. k
3. l
4. m
5. i
6. c
7. h
8. b
9. r
10. p
11. f

**OBJECTIVE 11**

1. g
2. j
3. b
4. c
5. d
6. i
7. f

**OBJECTIVE 12**

1. c
2. a

**OBJECTIVE 13**

1. b, d
2. e
3. c

| | |
|---|---|
| **OBJECTIVE 14** | 1. e<br>2. g<br>3. c<br>4. a |
| **OBJECTIVE 15** | 1. Patch<br>2. Chip bud<br>3. T-bud |
| **OBJECTIVE 16** | 1. B<br>2. FF<br>3. WT<br>4. FF<br>5. A<br>6. B<br>7. A |
| **OBJECTIVE 17** | Refer to answers to Assignment Sheet 1. |
| **OBJECTIVE 18** | Refer to answers to Assignment Sheet 2. |
| **OBJECTIVE 19** | Refer to answers to Assignment Sheet 3. |
| **OBJECTIVE 20** | Refer to Practical Tests for Job Sheets 1 through 11. |

**OBJECTIVE SHEET**

# INTRODUCTION TO INDOOR PLANTS

# XV

## INTRODUCTION

Interior plantscapes enrich the decor and architecture of indoor spaces. Living plants add color, beauty, and a feeling of lushness to reception areas, lobbies, offices, and all public meeting places. The care and maintenance of these plants is the responsibility of a trained horticulturist, whether self-employed in a small business or employed by a major greenhouse or interior design company. Knowing the most common plants and their requirements and recognizing when they should be replaced will form a foundation for employment in several career areas.

## UNIT OBJECTIVE

After completing this unit, the student will be able to identify indoor plants, describe their uses, and identify the characteristics of sick plants. The student will demonstrate these competencies by completing the assignment sheet and written test with a minimum of 85 percent accuracy.

## SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Distinguish between types of indoor plants.
2. List primary uses of indoor plants.
3. Explain environmental factors that affect indoor plant maintenance.
4. Describe categories of plant lighting requirements.
5. Select from a list characteristics of sick plants.
6. Name common plant pests.
7. Identify 25 common indoor plants.
8. Place plants according to their lighting requirements. (Assignment Sheet 1)

**PREPARATION**

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Select and order materials to supplement unit.
- Contact local greenhouses and the businesses that use their services. Learn the scope of indoor plant production, sales, and uses in your community.
- Plan a trip to a local greenhouse to observe the range of plants grown and cared for.
- Arrange for a speaker to provide a guided tour of the greenhouse to discuss the plants and demonstrate how to identify healthy and unhealthy plants.
- Locate good examples of plants used to enhance an otherwise barren environment. If field trips are impractical, or sites are not ideally located, use photographs or slides to demonstrate the same principles.
- Obtain a photographic light meter to measure light in various parts of the classroom.
- Have students build scale models of buildings and aim a light into the buildings approximating the location of the sun. Use the model to give students hands-on practice in placing plants both "indoors" and "outdoors."

**DELIVERY**

**Objectives 1 through 4**

- Show the students samples of tropical plants and succulents and discuss their particular needs.
- Demonstrate primary uses of indoor plants using pictures or a field trip.

- Demonstrate how ventilation and people-abuse affect plant maintenance.

**Objectives 5 through 7**

- Use a photographic light meter to demonstrate the amount of light in the different parts of the room.
- Use a model or scale drawings to practice placing plants in the most appropriate locations.

## APPLICATION

- Tell students to use Supplement 1 to complete Assignment Sheet 1.

## EVALUATION

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activity if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *4-H Horticulture Identification Video Tape*. 1 hr. 58 min., total, 16 min. 52 sec. on "House Plants." Tape covers nine areas of horticulture. Objectives are to teach students how to identify plants, how plants are classified and described, to prepare for contest, and to appreciate variation among species of plants. 4-H Horticulture Identification Card is available to supplement the tape.

  Available from Dean McCraw, Dept. of Horticulture and Landscape Architecture, Oklahoma State University, Stillwater, OK 74078-0481, Telephone (405) 744-5409.

- *Agri-Quiz*. Plant identification, questions and answers on computer disks for IBM PC or compatible, 640K. Asks 25 questions over each area of horticulture. Allows individual and team competition.

  Available from Midwest AGribusiness Services, Inc. 6739 Glacier, West Bend, Wisconsin 53095-9360.

**Publications**

- Reiley, H. Edward and Shry, Carrol, *Introductory Horticulture*, 2nd. Ed. Albany, NY: Delmar Publishers, Inc., 1983.
- George Seddon, *The Best Plant Book Ever*, New York: Rand McNally & Co., 1980.
- Richardson, William B. and Moore, Gary E., *Working in Horticulture*, New York: McGraw Hill Co., 1980.
- *Success with House Plants*, 1983, Pleasantville, NY: The Readers Digest Association, Inc., 1983

# INFORMATION SHEET | INTRODUCTION TO INDOOR PLANTS | XV

**OBJECTIVE 1**

## Distinguish between types of indoor plants.

- Tropical plants are the most successful indoor plants because their life cycles don't require periods of cold temperatures. They must be kept warm and moist; are often grown in terrariums.

  EXAMPLES: African violet, Boston fern, creeping Charlie, parlor ivy, foxtail fern, mother-in-law's tongue

- Desert plants are popular because they require very little care and attention. Desert plants, also called succulents, have thick skins so that water will not evaporate through the skin. They prefer warm temperatures, dry soil, and light watering.

  EXAMPLES: Aloe variegata, old man cactus, carunculata, Christmas cactus

**OBJECTIVE 2**

## List primary uses of indoor plants.

- Replace greenery lost to city buildings and pavements
- Add beauty to homes and buildings as part of the architectural design
- Consume carbon dioxide and provide oxygen in return

**OBJECTIVE 3**

## Explain environmental factors that affect plant maintenance.

- **Lighting**—Single most important factor; determines all other needs in an indoor environment
- **Daylength**—Periods of light and darkness act as biological clocks; help regulate the plant's functions and trigger events such as budding and flowering

  EXAMPLE: Some "short day" plants, such as the Christmas cactus and the chrysanthemum, need long nights in order for flower buds to form.

- **Temperature**—Must be suitable for the specific plant, between 50° and 90° F

- **Humidity**—Should be between 30% and 60%. Too little humidity will dry the plant and too much will cause rotting and diseases
- **Amount of Water**—Varies widely according to plant species and growing medium. As with humidity, too little will dry the plant and too much will cause rotting and diseases
- **Water**—Must be free of harmful chemicals such as calcium and fluoride

  NOTE: Tap water is not always safe for potted plants. Calcium in tap water can be harmful to acid-loving plants. Fluoride is also harmful to plants. Water should sit overnight in an open container before use, so fluoride can evaporate.
- **Ventilation**—Air flow affects plant placement. Plants that need warmth may not survive where inrushing cold air can chill them, as in a hotel lobby. Adequate spacing between plants also prevents excess humidity and moisture-related diseases such as mildew
- **Growing medium**—Almost all indoor plants need to be well drained; soil should have the correct pH balance and enough nutrients for the specific plant variety
- **People**—Humans handle plants and pour drinks or drop cigarette ashes and butts into pots; plants get broken, pH and nutrient balance are disturbed

**OBJECTIVE 4**

**Describe categories of plant lighting requirements.**

- **Direct sun**—100% of the light reaches the plant
- **Bright filtered**—Light filtered by curtain or tree leaves; 60% to 75% of the light reaches the plant
- **Bright light**—The brightest light entering a sunny room that is not direct sunlight; 20% to 25% of the light reaches the plant
- **Medium light**—Light that enters the north-facing window; 9% to 10% of the light reaches the plant
- **Poor light**—Light that is in corners without windows; 3% to 5% of the light reaches the plant

**OBJECTIVE 5**

**Select from a list characteristics of sick plants.**

**NOTE:** Healthy plants maintain their color, blooms and attractiveness but grow very slowly, if at all, after they leave the greenhouse.

**CAUTION:** Children may eat indoor plants. Use only the safest, non-toxic chemicals for cleaning and maintaining plants.

- **Drooping**—Plant is not straight and firm, but sags; limp stems
- **Color**—Changes suddenly; may be partially yellow or spotted
- **Leaves**—Sudden loss of leaves; signs of insect damage
- **Physical damage**—The plant shows signs of physical damage and abuse

  EXAMPLE: Broken stems, leaves or stalks
- **Soil problems**—Caked or hard
- **Growth problems**—When plants are "going down" (losing color, blooms and attractiveness) they should be replaced

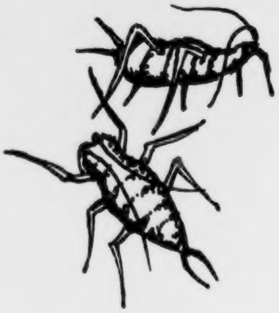
**OBJECTIVE 6**

**Name common plant pests.**

**NOTE:** Illustrations of insects have all been enlarged. They are not drawn to scale.

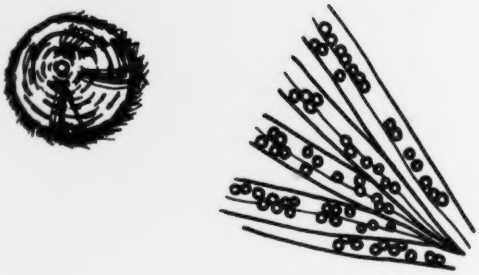
- Aphids

FIGURE 1



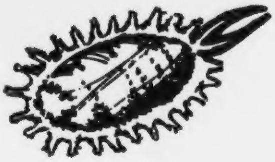
- Scale insects

FIGURE 2



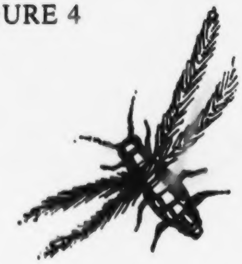
- Mealybugs

FIGURE 3



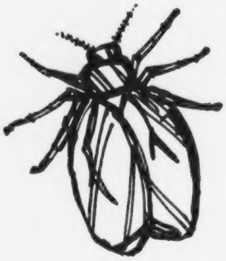
- Thrips

FIGURE 4



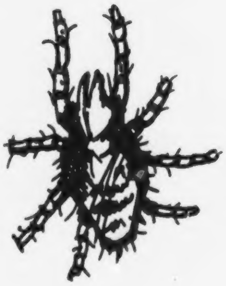
- Whiteflies

FIGURE 5



- Red spider mites

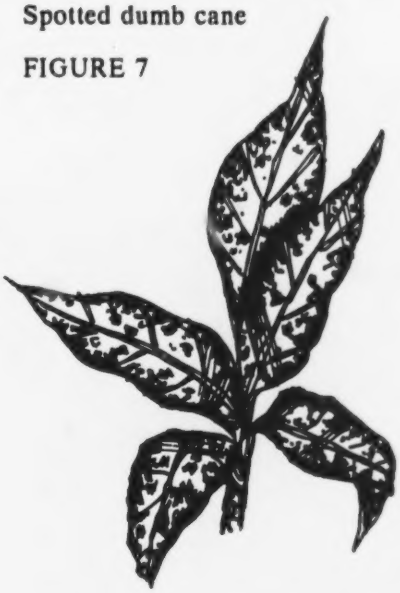
FIGURE 6



**OBJECTIVE 7** **Identify 25 common indoor plants.**

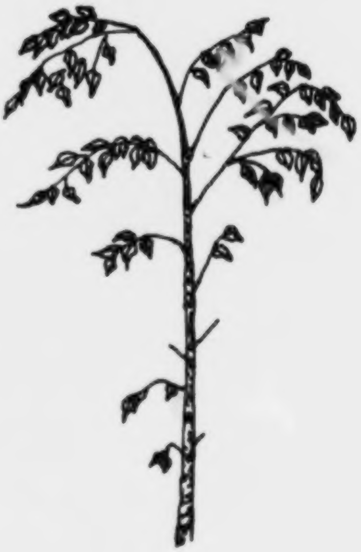
- Spotted dumb cane

FIGURE 7



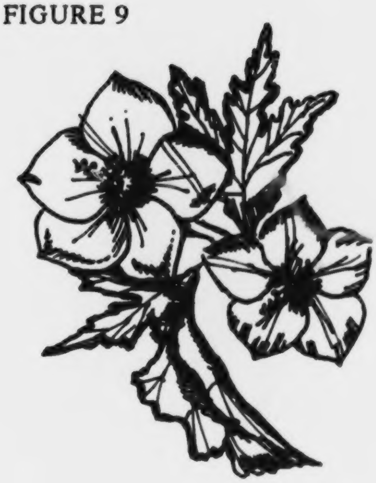
- **Weeping Fig**

  FIGURE 8



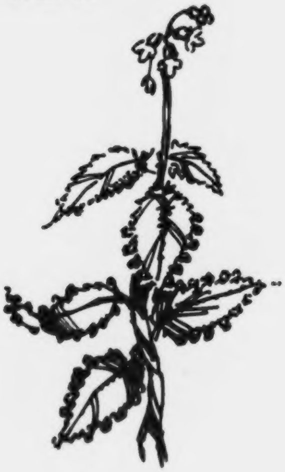
- Rose of China

FIGURE 9



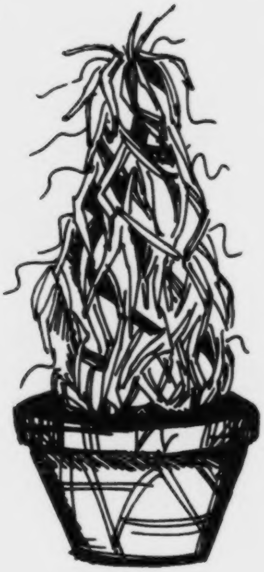
- Devil's backbone

FIGURE 10



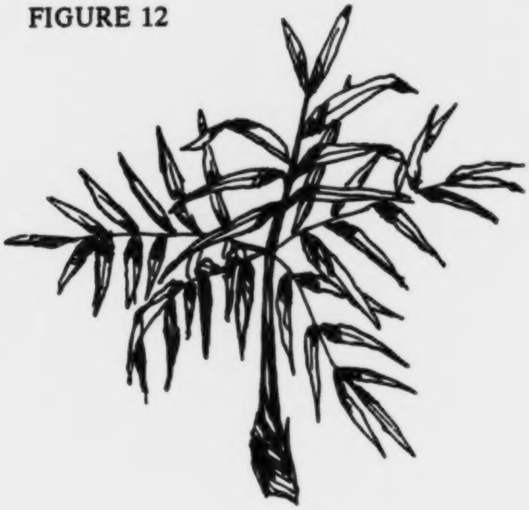
- Old man cactus

FIGURE 11



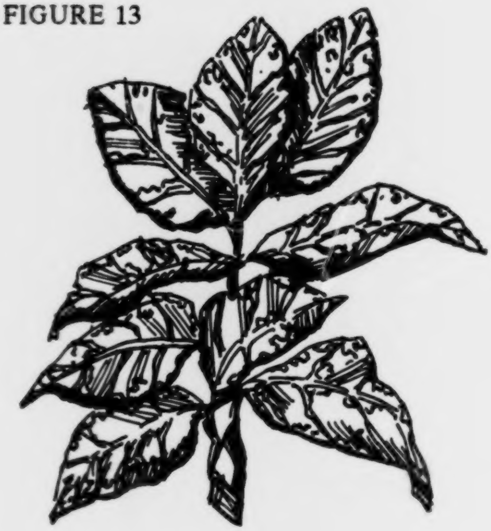
- Parlor palm

FIGURE 12



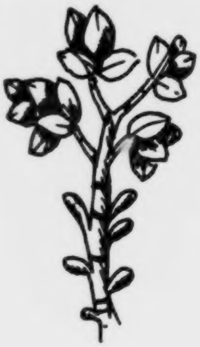
- Croton

FIGURE 13



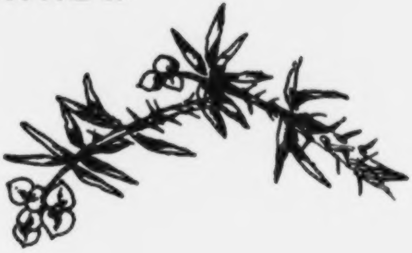
- Jade tree

FIGURE 14



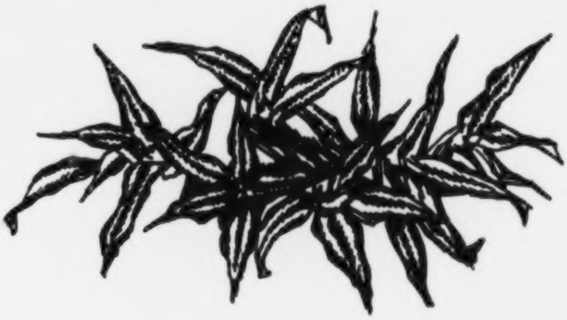
- Crown of thorns

  FIGURE 15



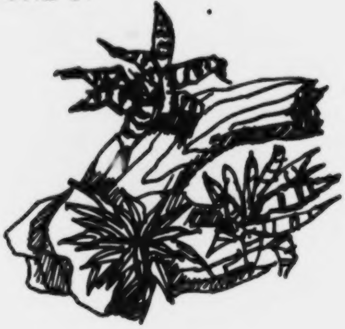
- Earth star

  FIGURE 16



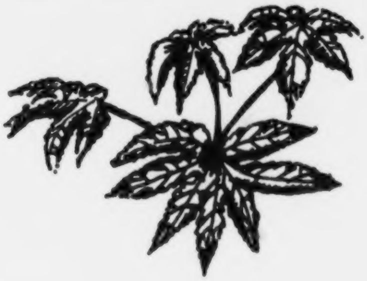
- Cryptanthus

FIGURE 17



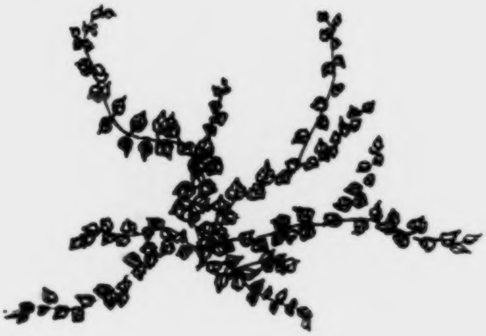
- Japanese fatsia

FIGURE 18



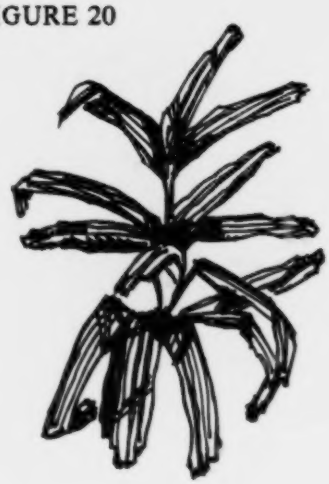
- **Creeping fig**

**FIGURE 19**



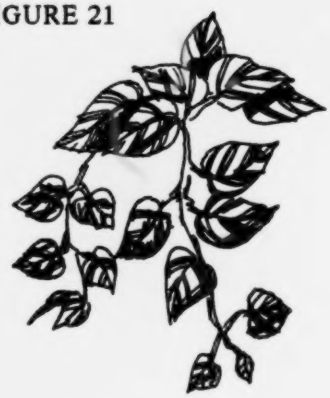
- **Slender lady palm**

**FIGURE 20**



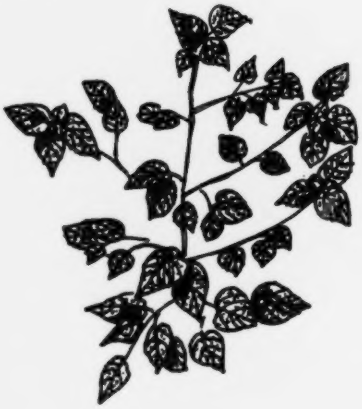
- Devils ivy

  FIGURE 21



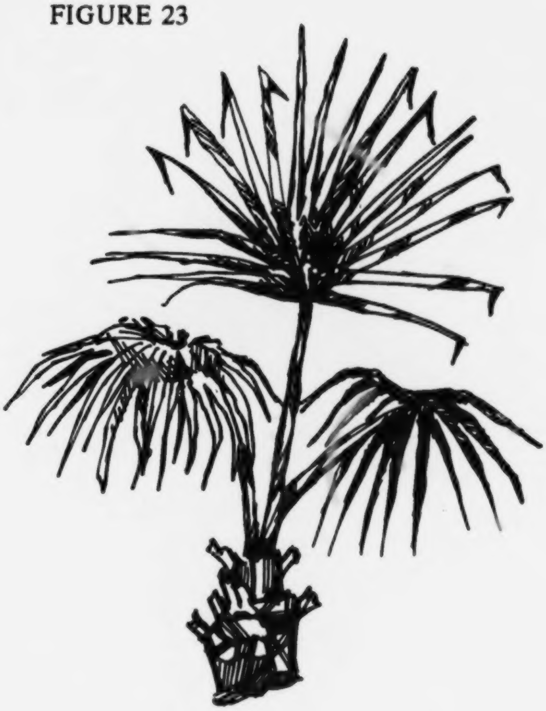
- Baby's tears

  FIGURE 22



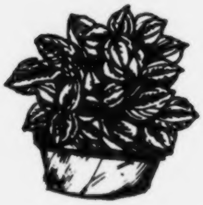
- Chinese fan palm

FIGURE 23



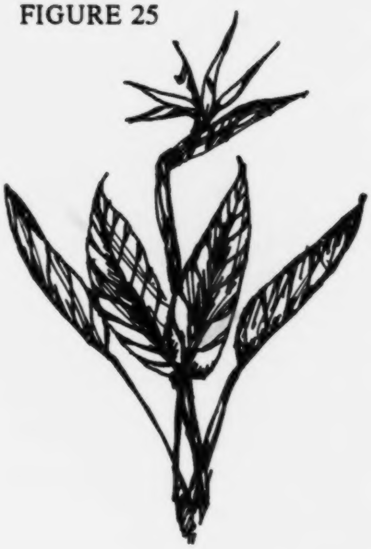
- Aluminum plant

FIGURE 24



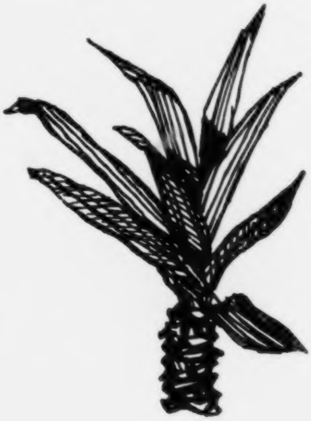
- Bird of paradise

FIGURE 25



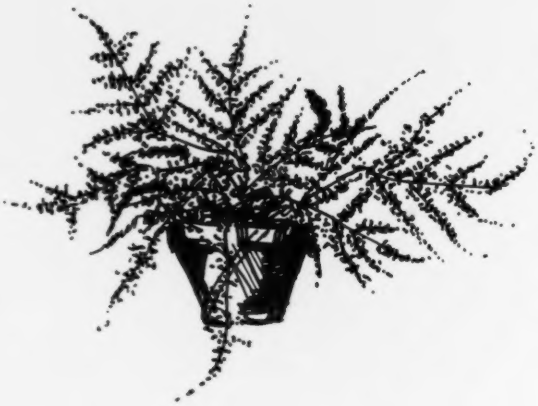
- Moses-in-the-cradle

FIGURE 26



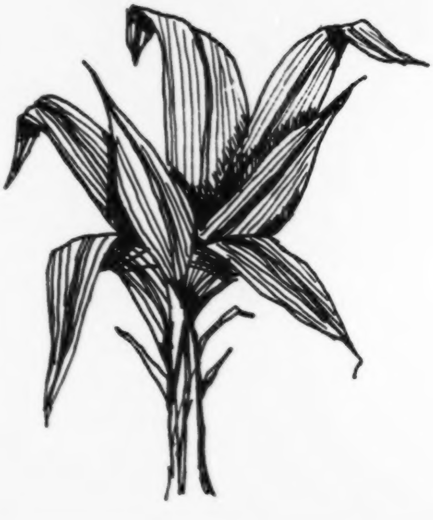
- Asparagus fern

FIGURE 27



- Cast iron plant

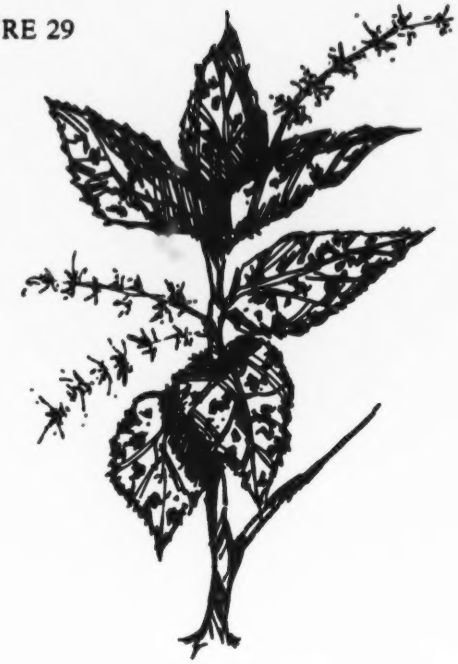
FIGURE 28



997

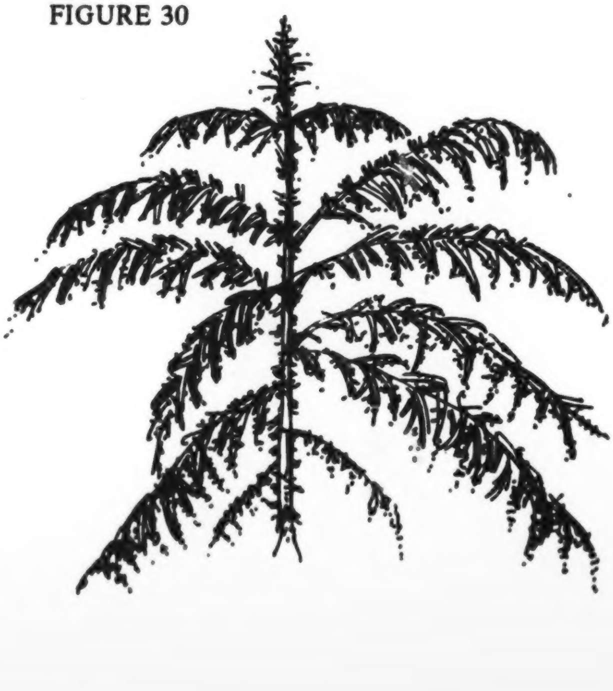
- **Jacob's coat**

**FIGURE 29**



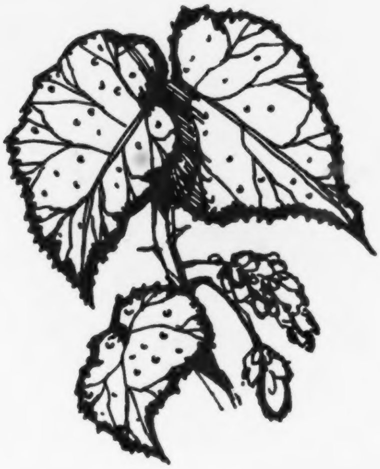
- **Norfolk Island pine**

**FIGURE 30**



- Angel wing begonia

FIGURE 31



## LIGHT ENTERING A ROOM

Plants are classified by the amount of light they need:

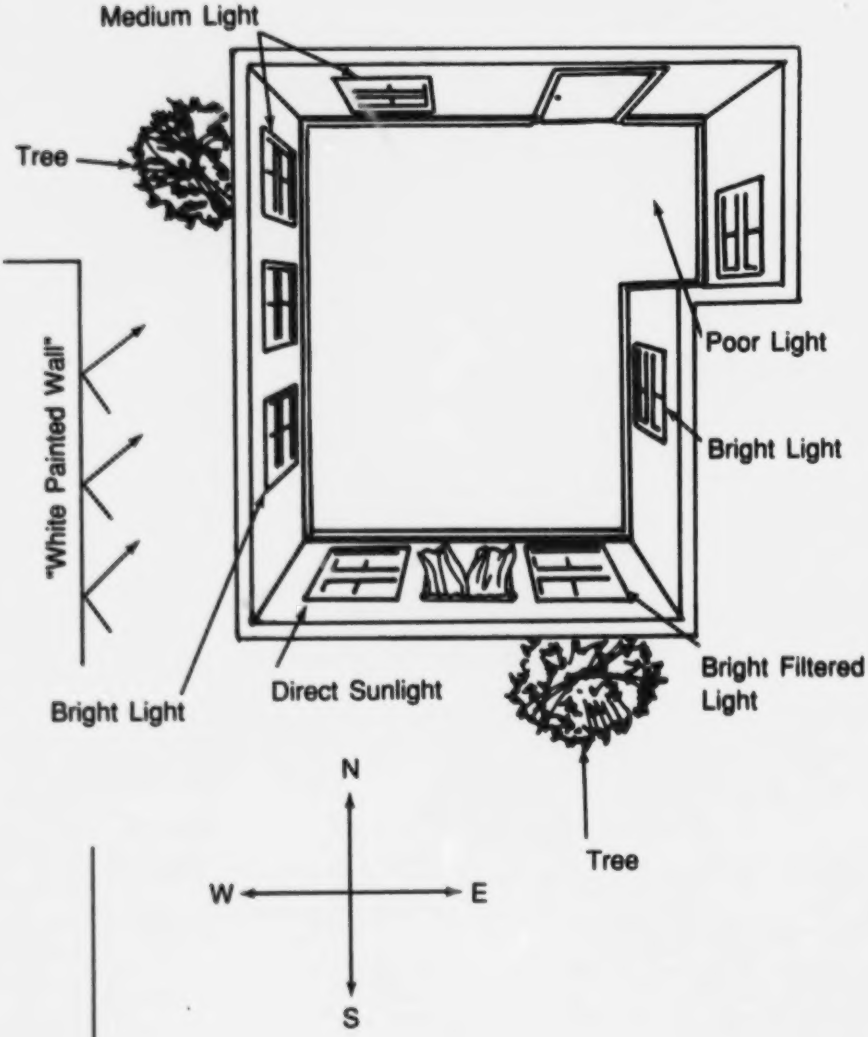
- Direct sun—100% of the light reaches the plant. This light comes in from South-facing windows.
- Bright filtered—Light filtered by curtain or tree leaves; 60% to 75% of the light reaches the plant. Also comes from a south-facing window.
- Bright light—The brightest light entering a sunny room that is not direct sunlight; 20% to 25% of the light reaches the plant. This light may come from an east-facing window, or may be reflected into a west-window by another building or wall.
- Medium light—Light that enters the north-facing window; 9% to 10% of the light reaches the plant; may also come through a west-facing window filtered by a tree or curtain.
- Poor light—Light in corners without windows; 3% to 5% of the light reaches the plant. Light from an east-facing window, substantially reduced by corners or other objects. Almost always too little light for healthy plants; no plants should be placed in poor light.

**LEGEND:**

1. Bright filtered light
2. Poor light
3. Bright light
4. Bright light
5. Medium light
6. Medium light
7. Direct sunlight

1000

FIGURE 32


Medium Light
Tree
"White Painted Wall"
Poor Light
Bright Light
Bright Filtered Light
Direct Sunlight
Bright Light
Tree
N
W
E
S

1001

## ASSIGNMENT SHEET 1 — INTRODUCTION TO INDOOR PLANTS

## XV

NAME ______________________________ SCORE _______

**OBJECTIVE 8**

**Place plants according to their lighting requirements.**

**INTRODUCTION**

Lighting is the single most important factor in placing indoor plants. Plant color, photosynthesis, growth and good absorption of nutrients depend on sunlight. Yet, plant varieties have specific lighting needs. While an old man cactus thrives in direct sunlight, that same amount of sun will burn the leaves of an aluminum plant.

For interior design, horticulturists want to be sure the plants they place in a space will thrive, showing lush foliage and bright flowers. The first requirement is knowing the light levels in the room. The direction windows face (north, south, east, or west) determines how much natural light enters a room and is available to plants.

**DIRECTIONS**

1. Make a chart describing categories of light and plants that require that amount of light. Use the Supplement to fill in the first three columns and the list on the next page to fill in the fourth column.

## COMMON INDOOR PLANTS AND THEIR LIGHTING REQUIREMENTS

Norfolk Island pine—medium light
Asparagus fern—bright light, never direct sunlight
Cast iron plant—medium light, tolerates poor light
Devil's backbone—bright light, no direct sunlight
Old man cactus—direct sunlight
Parlor palm—bright filtered light
Jade tree—bright light, some direct sunlight
Creeping Fig—medium light
Baby's Tears—bright filtered light
Aluminum Plant—medium, no direct sunlight
Slender Lady Palm—bright filtered light
Crown of thorns—bright filtered and direct sunlight

# TYPES OF LIGHT, THEIR SOURCES, AND PLANTS THAT REQUIRE EACH TYPE

| Type of Light | % of Light to Plant | Describe Source and Windows Facing: | Plants |
|---|---|---|---|
| Direct sun | | | |
| Bright filtered | | | |
| Bright light | | | |
| Medium light | | | |
| Poor light | | | |

1004

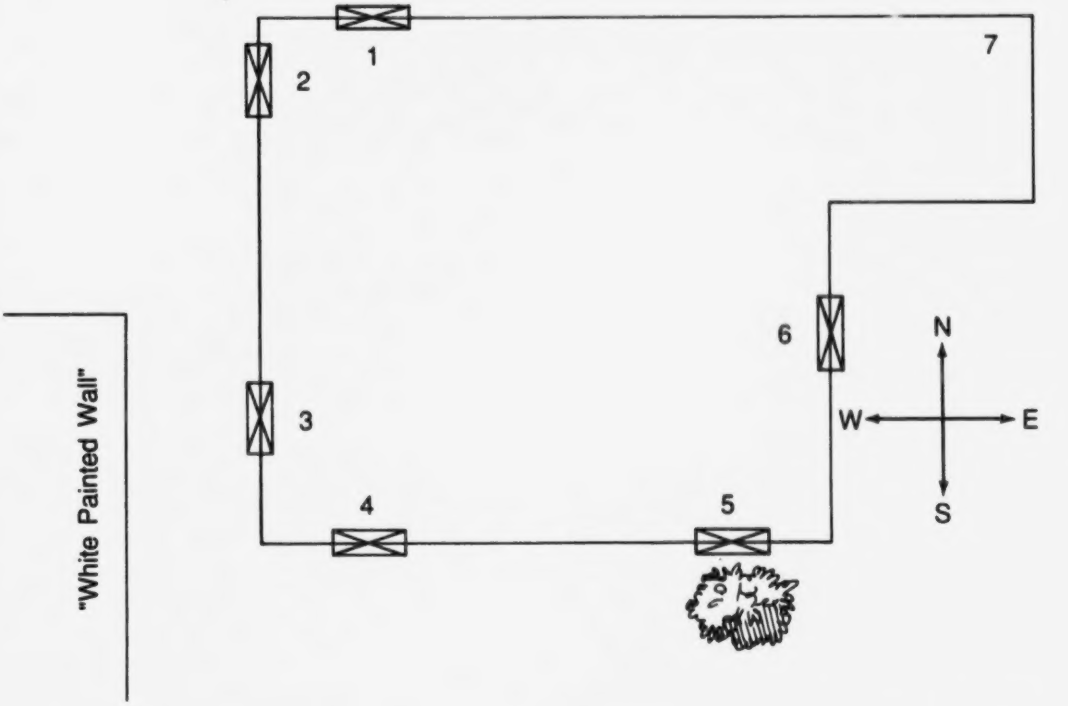
2. Study the floorplan below. Each number stands for a spot where a plant is to be placed.

   a. Determine the kind of light at each number. Use your chart.

   b. Choose a plant or plants that need the light available in that spot.

   c. On the next page, write the plant name, or names if you choose more than one, next to the number of the spot where you would place it. Explain what lighting factors influenced your decision. The first one is done for you.

FIGURE 33



1. *Creeping fig and Norfolk Island pine need medium light*

2.

3.

4.

5.

6.

7.

**ASSIGNMENT SHEET 1**

## 1. TYPES OF LIGHT, THEIR SOURCES, AND PLANTS THAT REQUIRE EACH TYPE

| Type of Light | % of light to plant | Describe source & windows facing: | Plants |
|---|---|---|---|
| Direct sun | 100% | South | Old man cactus<br>Crown of thorns |
| Bright filtered | 60-75% | Through curtain or tree leaves; south window | Parlor palm<br>Baby's tears<br>Slender lady palm<br>Crown of thorns |
| Bright light | 20-25% | East; or west reflected off a wall or building | Asparagus fern<br>Devil's backbone<br>Jade tree |
| Medium light | 6-10% | North; or west filtered by a tree or curtain | Norfolk Island pine<br>Cast iron plant<br>Creeping fig<br>Aluminum plant |
| Poor light | 3-5% | East, filtered by a tree or curtain | None |

2. Answer should include at least one of the following:
    1. Creeping fig, Norfolk Island pine, Cast iron plant, Aluminum plant—Medium light
    2. Creeping fig, Norfolk Island pine, Cast iron plant, Aluminum plant—Medium light curtain
    3. Asparagus fern, Devil's backbone, Jade tree—Bright light
    4. Crown of thorns, Old man cactus—Direct sun
    5. Parlor palm, Baby's tears, Slender Lady palm, Crown of thorns—Bright filtered sunlight
    6. Asparagus fern, Devil's backbone, Jade tree—Bright light
    7. No plants should be placed in poor light

**WRITTEN TEST**

# INTRODUCTION TO INDOOR PLANTS

# XV

**OBJECTIVE 1**

**Distinguish between types of indoor plants.** Write a "T" for tropical or a "D" for desert in the blank before each name.

___ 1. Boston fern

___ 2. Creeping Charlie

___ 3. Christmas cactus

___ 4. African violet

___ 5. Carunculata

___ 6. Mother-in-law's tongue

___ 7. Parlor ivy

___ 8. Foxtail fern

___ 9. Aloe variegata

___ 10. Old man cactus

**OBJECTIVE 2**

**List primary uses of indoor plants.**

1. ________________________________________

2. ________________________________________

3. ________________________________________

**OBJECTIVE 3**

**Explain environmental factors that affect indoor plant maintenance.** Where appropriate, give the ranges involved such as "depth is 5 to 7 inches."

1. Lighting— ________________________________________

________________________________________

________________________________________

________________________________________

2. Daylength— ________________________________________

________________________________________

________________________________________

________________________________________

3. Temperature— ________________________________________

________________________________________

________________________________________

________________________________________

4. Growing medium— ________________________________________

________________________________________

________________________________________

________________________________________

5. People— ________________________________________

________________________________________

________________________________________

________________________________________

6. Humidity— ________________________________________

________________________________________

________________________________________

________________________________________

7. Water—

8. Ventilation—

**OBJECTIVE 4** **Describe categories of plant lighting requirements.**

1.

2.

3.

4.

5. ________________________________________

________________________________________

________________________________________

________________________________________

**OBJECTIVE 5**

**Select from a list characteristics of sick plants.** Write an "X" in the blank before each correct statement.

____1. Caked or hard soil

____2. Physical signs of damage and abuse

____3. Partially yellow or spotted leaves

____4. Hygrogated stems

____5. Variegation

____6. Serrated leaves

____7. Sudden loss of leaves

____8. Color changes suddenly

____9. Inverted stamens

___10. Loose flaky soil

___11. Photosynthesis

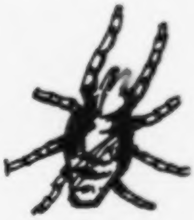
___12. Plant is not straight and firm, but sags

___13. Limp stems

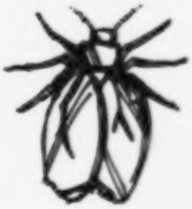
___14. Plants grow very slowly

**OBJECTIVE 6**

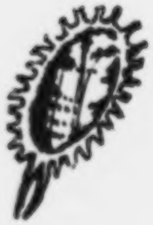
**Name common plant pests.** Write the correct names in the blanks.



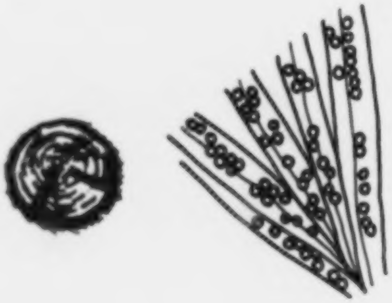
1. ____________________



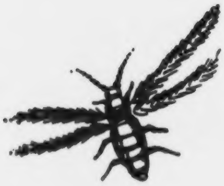
2. ____________________



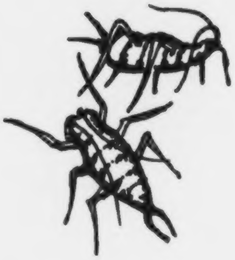
3. ____________________



4. ____________________



5.________________



6.________________

**OBJECTIVE 7**

**Identify 25 common indoor plants.** Write the correct letters in the blanks.

a. Weeping Fig

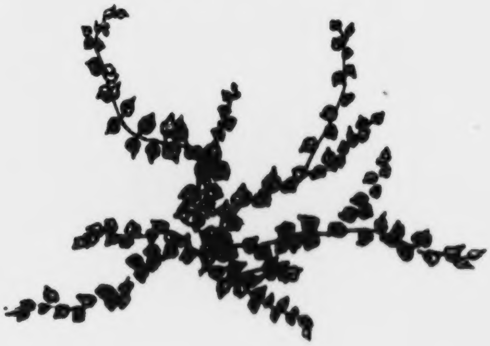
b. Rose of China

c. Baby's Tears

d. Creeping fig

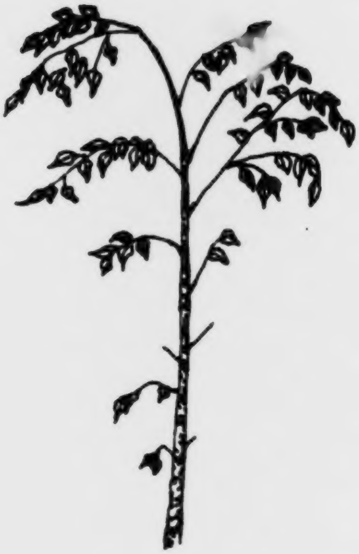
e. Chinese Fan Palm

f. Slender Lady Palm

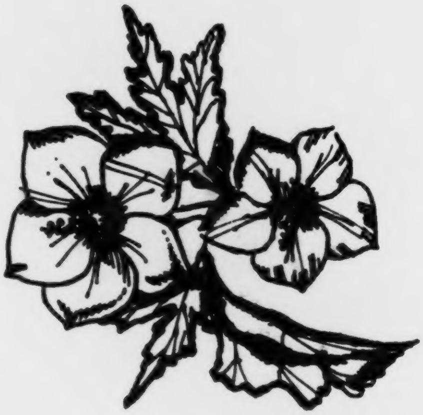


1. ____________________

1017

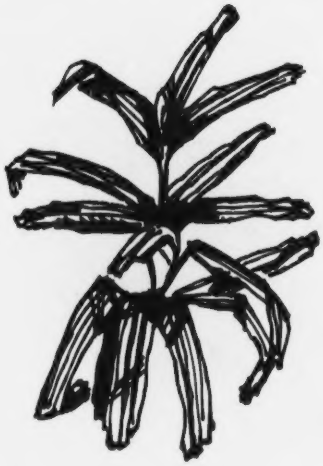


2.______________________



3.______________________

1018



4. ______________________

a. Devil's ivy

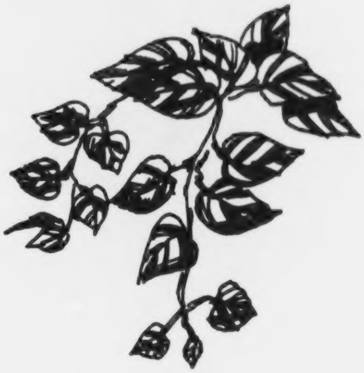
b. Bird of paradise

c. Asparagus fern

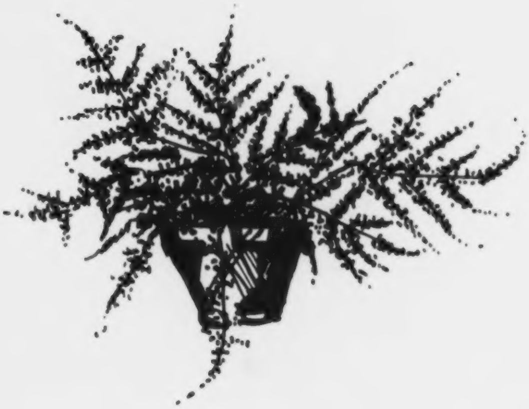
d. Cast iron plant

e. Angel wing begonia

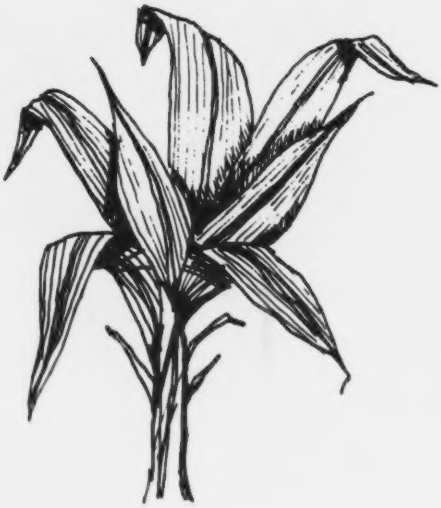
f. Passion flower



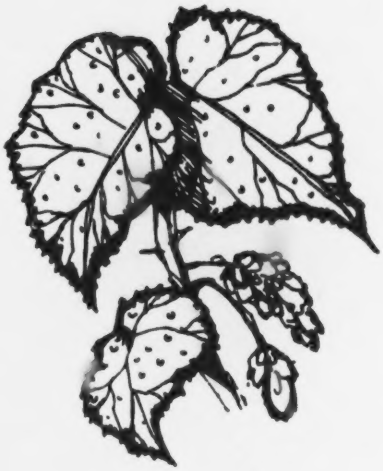
5.____________________



6. ______________________



7. ______________________



8.________________________

a. Jade tree

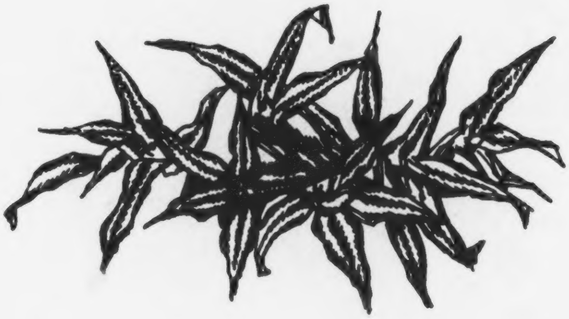
b. Earth star

c. Cryptanthus

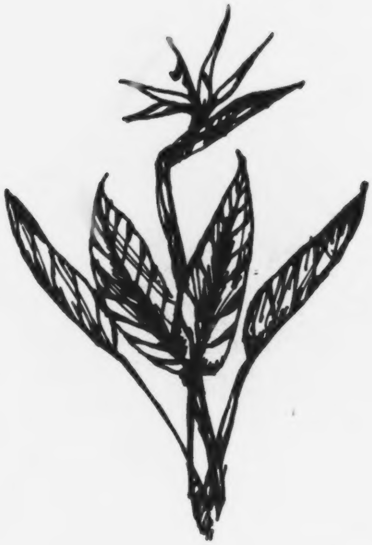
d. Devils Ivy

e. Bird of Paradise

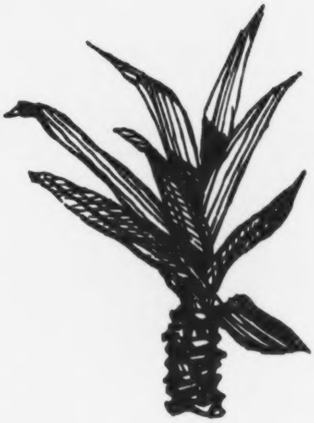
f. Moses in the Cradle



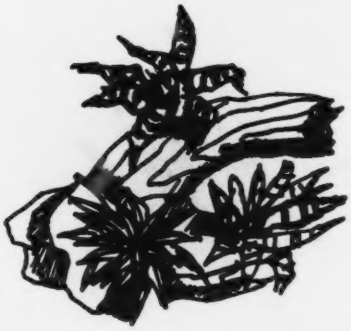
9. ____________________



10.________________________



11.________________________



12. ____________________

a. Rose of China

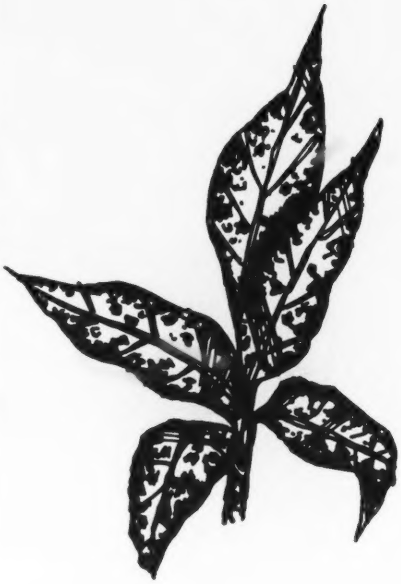
b. Baby's Tears

c. Spotted dumb cane

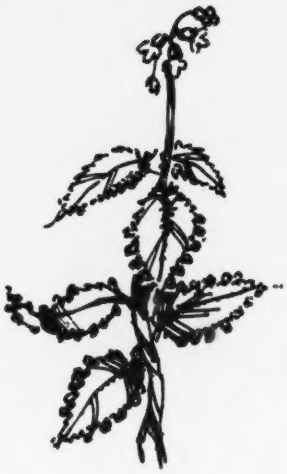
d. Devils Backbone

e. Old man cactus

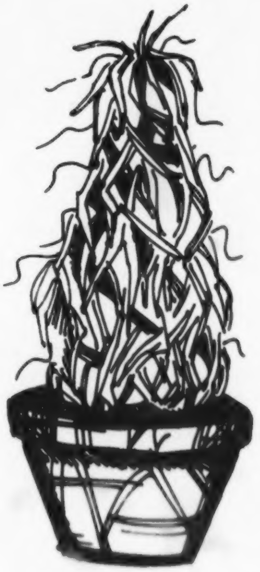
f. Parlor palm



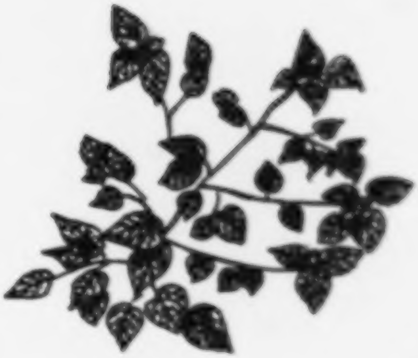
13.____________________



14. ______________________



15. ______________________



16.____________________

a. Parlor palm

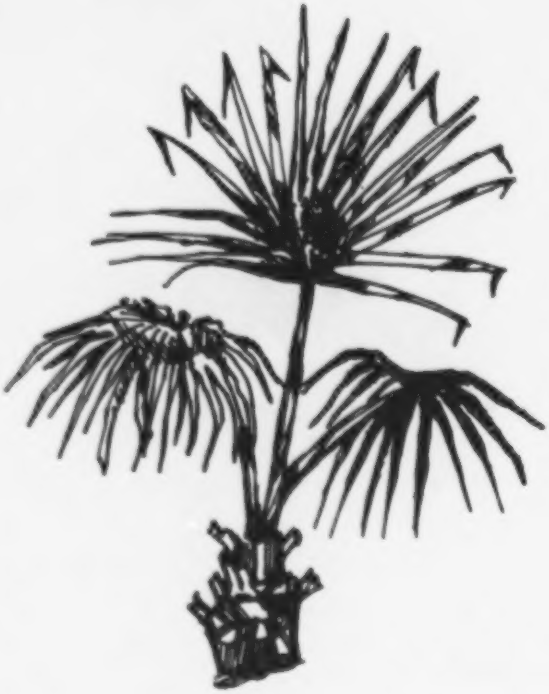
b. Crocus

c. Croton

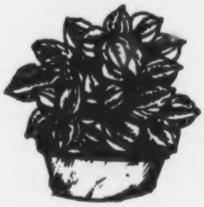
d. Baby's Tears

e. Chinese Fan Palm

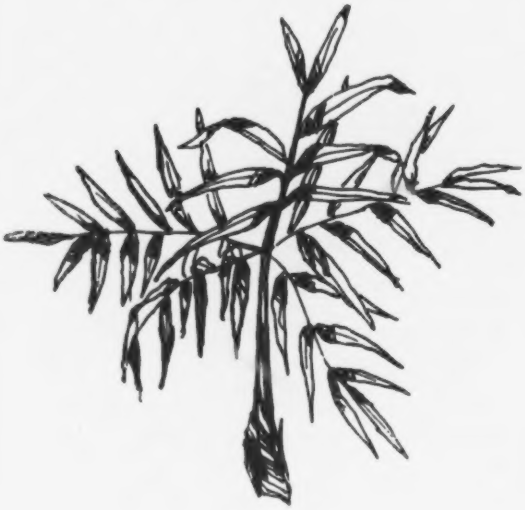
f. Aluminum Plant



17. ____________________

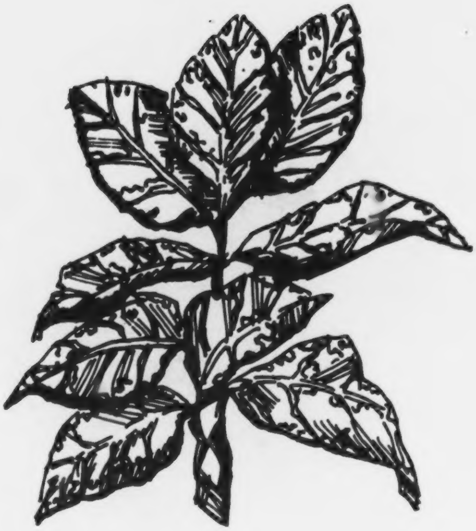


18.____________________



19.____________________

1030



20. ____________________

a. Jade tree

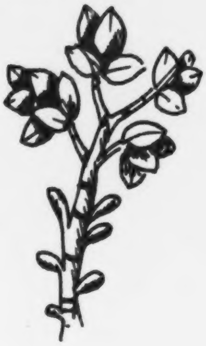
b. Earth star

c. Cryptanthus

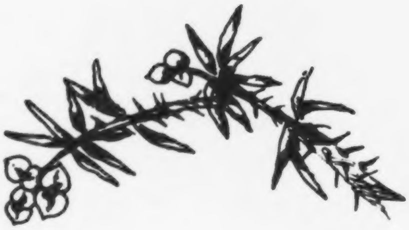
d. Crown of thorns

e. Jacob's coat

f. Japanese fatsia

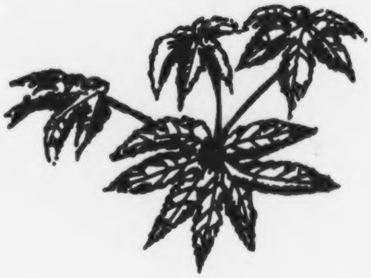


21.____________________

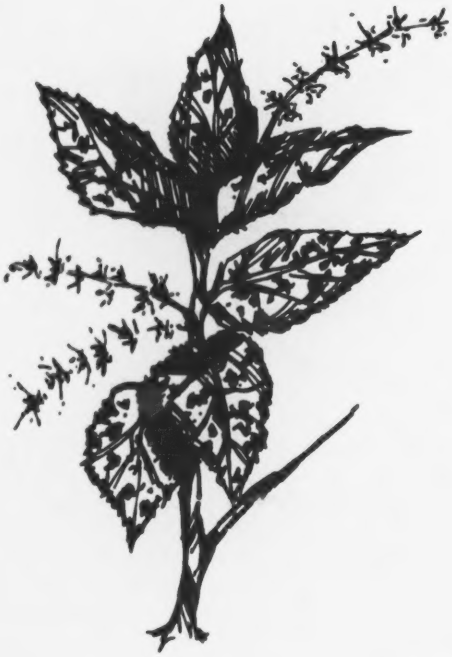


22.____________________

1032



23. ____________________



24. ____________________

1033

a. Jacob's coat

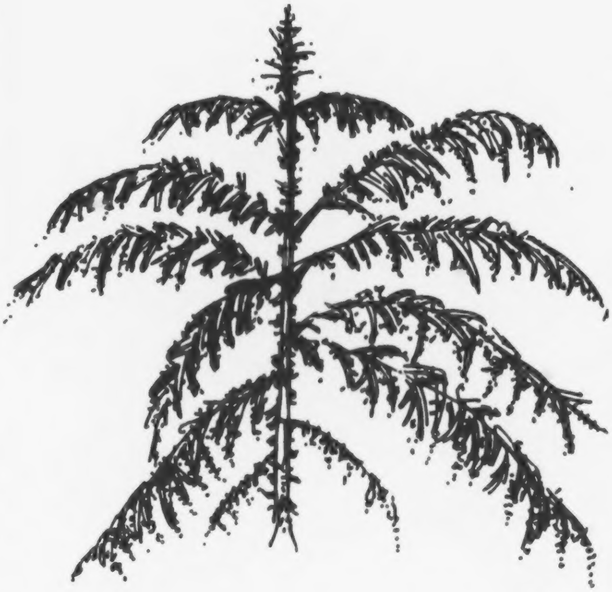
b. Norfolk Island pine

c. Jade tree

d. Asparagus fern

e. Cast iron plant

f. Angel wing begonia



25.________________

**NOTICE** The following assignment sheet is not a part of the written test. If this activity has not been completed, check with your instructor.

**OBJECTIVE 8** **Place plants according to their lighting requirements.**

SCORE ________

## WRITTEN TEST ANSWERS

## INTRODUCTION TO INDOOR PLANTS

## XV

**OBJECTIVE 1**

1. T
2. D
3. T
4. T
5. D
6. T
7. T
8. D
9. D
10. T

**OBJECTIVE 2**

1. Replace greenery lost to city buildings and pavements.
2. Consume carbon dioxide and give us oxygen in return.
3. Add beauty to homes and buildings as they become part of the architectural design.

**OBJECTIVE 3**

1. Lighting—Single most important factor; determines all other needs in an indoor environment.
2. Daylength—Periods of light and darkness act as biological clocks; help regulate the plant's functions and trigger events such as budding and flowering.
3. Temperature—Must be suitable for the specific plant, between 50° and 90° Fahrenheit.
4. Humidity—Should be between 30% and 60%. Too little humidity will dry the plant and too much will cause rotting and diseases.
5. Amount of Water—Varies widely according to plant species and growing medium. As with humidity, too little will dry the plant and too much will cause rotting.
6. Water—Must be free of harmful chemicals such as calcium and fluoride
7. Ventilation—Air flow affects plant placement. Plants that need warmth may not survive where inrushing cold air can chill them, as in a hotel lobby. Adequate spacing between plants also prevents excess humidity and moisture-related diseases such as mildew.

8. Growing medium—Almost all indoor plants need to be well drained; soil should have the correct pH balance and enough nutrients for the specific plant variety.

9. People—Humans handle plants and pour drinks or drop cigarette ashes and butts into pots; plants get broken; pH and nutrient balance are disturbed.

**OBJECTIVE 4**

1. Direct sun—100% of the light reaches the plant.

2. Bright filtered—Light filtered by curtain or tree leaves; 60% to 75% of the light reaches the plant.

3. Bright light—The brightest light entering a sunny room that is not direct sunlight; 20% to 25% of the light reaches the plant.

4. Medium light—Light that enters the north-facing window; 9% to 10% of the light reaches the plant.

5. Poor light—Light that is in corners without windows; 3% to 5% of the light reaches the plant.

**OBJECTIVE 5**

1, 2, 3, 7, 8, 12, 13, 14

**OBJECTIVE 6**

1. Red spider mite

2. Whitefly

3. Mealybug

4. Scale insects

5. Thrip

6. Aphid

**OBJECTIVE 7**

1. d
2. a
3. b
4. f
5. a
6. c
7. d
8. e
9. b
10. e
11. f
12. c
13. c
14. d
15. e
16. b
17. e
18. f
19. a
20. c
21. a
22. d
23. f
24. e
25. b

**OBJECTIVE 8**

Refer to answers to Assignment Sheet 1.

**OBJECTIVE SHEET**

# REPOTTING GREENHOUSE AND INDOOR PLANTS

# XVI

## INTRODUCTION

The pot in which a greenhouse or indoor plant grows is its "home." In order for these plants to grow and remain healthy they must be placed in pots that are suitable for them.

## UNIT OBJECTIVE

After completing this unit, the student will be able to identify types of containers, select the proper container, and repot a plant. The student will demonstrate these competencies by completing a job sheet and written test with a minimum of 85 percent accuracy.

## SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Select from a list statements about materials used in making containers.
2. Match types of potting containers to their correct descriptions.
3. State factors used in selecting growing pots.
4. Select from a list reasons to use hanging baskets.
5. State signs that repotting is needed.
6. Demonstrate the ability to repot a plant. (Job Sheet 1)

# SUGGESTED ACTIVITIES — REPOTTING GREENHOUSE AND INDOOR PLANTS — XVI

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Select and order materials to supplement unit.
- Order enough materials for each student to repot a plant.
- Evaluate local resources such as agricultural extension offices, greenhouses, and the businesses that use their services. Plan a trip to a local greenhouse to observe the range of plants grown and cared for. Arrange for a speaker to provide a guided tour to discuss the plants and types of pots and to demonstrate the method for repotting a plant.
- Locate good examples of potted plants used in local businesses. If field trips are impractical, or sites are not ideally located, use photographs or slides to demonstrate pots and their uses.

## DELIVERY

**Objectives 1 through 4**

- Set up a display of plastic and clay pots.
- Display pots with different drainage holes.

**Objective 5**

- Arrange for samples of house plants in need of repotting and discuss their particular needs.
- Demonstrate repotting.
- Provide materials for students to repot at least one plant.
- Distribute Job Sheet 1.

## APPLICATION

**Objective 6**

- Use Job Sheet 1 to have students demonstrate the ability to choose a pot and correctly repot a plant

## EVALUATION

**Practical Test**

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Select from a list the rating scale used on the practical test.
- Reteach and retest as necessary.

**Written test**

- Explain to students that they will need to demonstrate on the written test [illegible]ions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not already done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *How to Grow Healthy Houseplants*, 1/2" VHS, Color, 60 min, 1988, Burpee. Section 5 covers how to repot, clean, and prune plants to keep them beautiful. Order No. V153.

  **NOTE:** This film is available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074.

**UNIT REFERENCES**

- Baudendistel, Robert F. *Horticulture: A Basic Awareness*, Reston, Virginia: Reston Publishing Co., 1979.
- Reiley, H. Edward and Shry, Carroll L. *Introductory Horticulture*, Third Ed. Albany, N.Y.: Delmar Publishers, Inc. 1988.
- Richardson, William B. and Moore, Gary E. *Working in Horticulture*, N.Y.: McGraw Hill Co., 1980.
- Seddon, George. *The Best Plant Book Ever*, New York: Rand McNally & Co. 1980.
- *Success with House Plants*, Pleasantville, NY: The Readers Digest Association, Inc., 1983.

**INFORMATION SHEET**

# REPOTTING GREENHOUSE AND INDOOR PLANTS

# XVI

**OBJECTIVE 1**

**Select from a list statements about materials used in making containers.**

- Virtually all containers are now made of plastic.
- Plastic pots are cheaper, lighter, and come in a variety of colors. Plastic pots are the standard of the industry. They are easier to find than clay, sturdier and cheaper to ship.
- Clay is seldom used commercially except for cactus and succulents.
- Clay pots dry out faster but also provide better air circulation. Clay pots are heavier and break more easily, but they are also reusable.

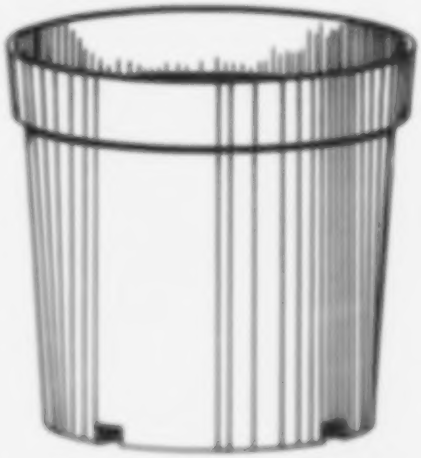
**OBJECTIVE 2**

**Match types of potting containers to their correct descriptions.**

- Standard pot—As wide as it is tall

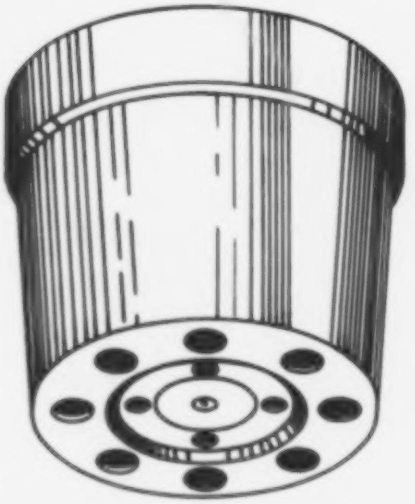
  **NOTE:** Standard sizes range from 4" to 10."

  FIGURE 1



- Geranium pot—Has more drainage holes than standard pots

FIGURE 2



- Azalea pot—As wide as standard pots but shorter; has both side and bottom holes

**NOTE:** Standard sizes increase by half-inches from 4"-10" in diameter at the top.

FIGURE 3

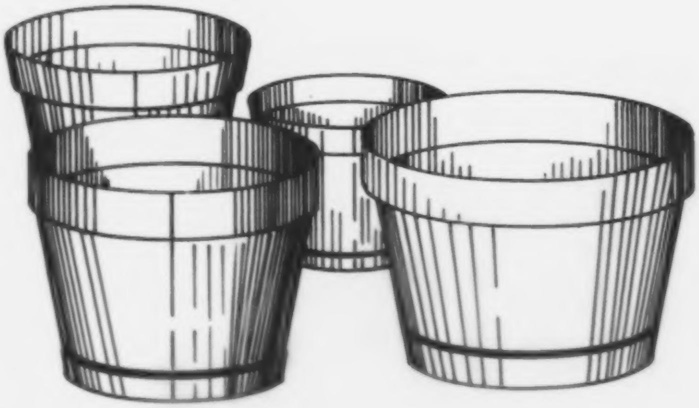
| | | |
|---|---|---|
| | 12 Hole Bottom only | 6½ Azalea (065AG) |
| | 6 Hole Side & Bottom | 7 Azalea (070AG) |
| | 12 Hole Bottom only | 7½ Azalea (075AG) |

Illustration used with permission of National Polymer, Inc.

- Jumbo pots—Used for large plants; typically placed in malls or businesses

  **NOTE:** Standard sizes are 12", 14", and 16" in diameter at the top.

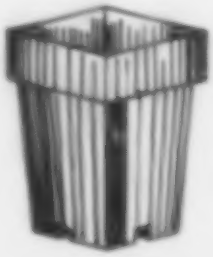
  FIGURE 4



- Square pots—Used where saving space is important

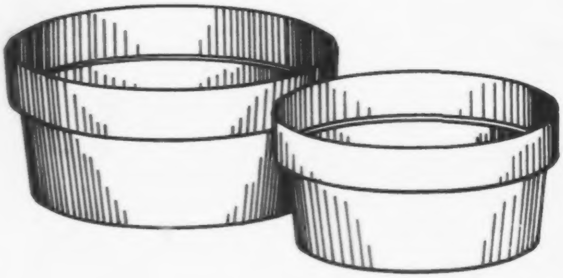
  EXAMPLES: Square pots save space in storage and in shipping. They range in size from 1 3/4" to 4 1/2."

  FIGURE 5



- Bulb pans—Shallow and much wider than they are tall

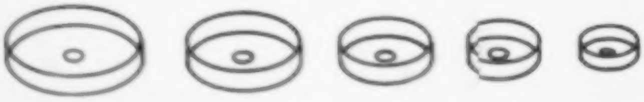
FIGURE 6



- Saucer—Used to provide a source of water that can be pulled up from the roots

NOTE: Water poured on from the top drains the nourishment down and away from the plant's roots.

FIGURE 7



**OBJECTIVE 3**

**State factors used in selecting growing pots.**

- Pot should have one or more drainage holes to keep the plant from drowning.
- Pots for indoor plants should be no more than one or two inches larger in diameter than the current pot so roots will reach toward the edge of the pot for aeration.
- Pots must be well-cleaned and sterilized to prevent the spread of diseases.
- Previously used pots should be scrubbed clean and disinfected with a solution of bleach and water.

  EXAMPLE: 9 parts water plus one part bleach
- Tall plants need a wide, heavy pot for support.

**OBJECTIVE 4**

**Select from a list reasons to use hanging baskets.**

NOTE: Vining plants, such as the "Hanging Basket Begonia," Wandering Jew, and philodendrons are natural hanging plants.

- Place the plant closer to light source.
- Place color and beauty of plant at eye level.
- Show off the beauty of naturally vining plants.
- Place plants which normally hang from other plants or objects in a natural setting.

**OBJECTIVE 5**

**State signs that repotting is needed.**

- Plants are top-heavy or too large for the current pot
- Growth slows down
- Plant needs more frequent watering
- Plant has become rootbound

  NOTE: Some plants such as palms, scheffleras, and African violets thrive when rootbound.

## JOB SHEET 1 — REPOTTING GREENHOUSE AND INDOOR PLANTS — XVI

**OBJECTIVE 6** Demonstrate ability to repot a plant.

**TOOLS AND MATERIALS**

- Medium
- New pot or sterilized, if the pot has been used previously
- Spoon or trowel
- Plant that needs repotting
- Water

**PROCEDURE**

1. Thoroughly water, but do not soak the plant.
2. If roots have grown through drainage holes, trim them off.
3. Place fresh, sterilized medium into bottom of new pot.
4. Invert the plant while cradling the stem and rootball with fingers.

FIGURE 8

5. Tap rim of inverted pot on table while pulling up on the pot until rootball is free.
6. Place plant and rootball into new pot.
7. Fill in around the plant with the fresh, sterilized medium.
8. Water thoroughly.

**PRACTICAL TEST 1**

## REPOTTING GREENHOUSE AND INDOOR PLANTS

# XVI

**JOB SHEET 1**

**Demonstrate ability to repot a plant.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check in the "Yes" or "No" blanks to designate whether the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Watered the plant thoroughly but did not soak it. | _____ | _____ |
| 2. Trimmed off any roots that had grown through drainage holes. | _____ | _____ |
| 3. Placed fresh, sterilized medium into bottom of new pot. | _____ | _____ |
| 4. Inverted the plant while cradling the stem and rootball with fingers. | _____ | _____ |
| 5. Tapped rim of inverted pot on table while pulling up on the pot until rootball was free. | _____ | _____ |
| 6. Placed plant and rootball into new pot. | _____ | _____ |
| 7. Filled in around the plant with the fresh, sterilized medium. | _____ | _____ |
| 8. Watered thoroughly. | _____ | _____ |
| 9. Used proper tools correctly. | _____ | _____ |
| 10. Performed steps in a timely manner. | _____ | _____ |
| 11. Practiced safety rules throughout procedure. | _____ | _____ |
| 12. Provided satisfactory responses to questions asked. | _____ | _____ |
| 13. Put away tools and cleaned work area. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Repotted plant | 4 | 3 | 2 | 1 |
| Placed plant neatly and securely in pot | 4 | 3 | 2 | 1 |
| Cleaned up any spilled medium | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process, but is unable to perform job

**WRITTEN TEST**

## REPOTTING GREENHOUSE AND INDOOR PLANTS

## XVI

NAME ______________________________ SCORE _______

**OBJECTIVE 1**

**Select from a list statements about materials used in making containers.** Write an "X" in the blank before each true statement.

___ 1. Clay pots cost more to ship than plastic pots but are reusable.

___ 2. Glass containers are best for some plants.

___ 3. Clay pots are the standard of the industry.

___ 4. Paper mache is commonly used in dry areas.

___ 5. Plastic pots are cheaper and lighter than clay pots and come in a variety of colors.

___ 6. Clay is often used commercially except for cactus and succulents.

___ 7. Clay pots break more easily than plastic pots.

___ 8. Virtually all containers are now made of plastic.

___ 9. Clay pots dry out faster than plastic pots but also provide better air circulation.

___ 10. Clay pots kill fungi in plant roots.

___ 11. Plastic offers exceptional aeration compared to clay.

___ 12. Plastic pots are the standard of the industry.

___ 13. Clay is seldom used commercially except for cactus and succulents.

**OBJECTIVE 2**

**Match types of potting containers to their correct descriptions.** Write the correct letters in the blanks.

____1. As wide as it is tall

____2. Used where saving space is important

____3. Used to provide a source of water that can be pulled up from the roots

____4. Has more drainage holes than standard pots

____5. As wide as standard pots but shorter; have both side and bottom holes

____6. Shallower and much wider than they are tall

____7. Used for large plants; typically placed in malls or businesses

a. Geranium pot

b. Bulb pans

c. Jar pot

d. Saucer

e. Azalea pot

f. Samovar pot

g. Standard pot

h. Jumbo pot

i. Crocus pot

j. Bung pot

k. Square pot

l. Oxidation pot

**OBJECTIVE 3**

**State factors used in selecting growing pots.**

**OBJECTIVE 4** **Select from a list reasons to use hanging baskets.** Write an "X" in the blank before each correct reason.

___ 1. Place color and beauty of plant at eye level.

___ 2. Harden off plants before placing them outside.

___ 3. Show off the beauty of naturally vining plants.

___ 4. Place the plant farther from insects.

___ 5. Provide greater access to carbon dioxide.

___ 6. Place plants which normally hang from other plants or objects in a natural setting.

___ 7. Place the plant closer to light source.

___ 8. Place succulents near moist windows.

**OBJECTIVE 5** **State signs that repotting is needed.**

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**NOTICE** The following job sheet is not a part of the written test. If this activity has not been completed, check with your instructor.

**OBJECTIVE 6** Demonstrate the ability to repot a plant. RATING ______

**WRITTEN TEST ANSWERS**

# REPOTTING GREENHOUSE AND INDOOR PLANTS XVI

**OBJECTIVE 1**

1, 5, 7, 8, 9, 12, 13

**OBJECTIVE 2**

1. g
2. k
3. d
4. a
5. e
6. b
7. h

**OBJECTIVE 3**

Answer must include the following points:

- Pot should have one or more drainage holes to keep the plant from drowning.
- Pots for indoor plants should be no more than one or two inches larger in diameter than the current pot so roots will reach toward the edge of the pot for aeration.
- Pots must be well cleaned and sterilized to prevent the spread of diseases.
- Previously used pots should be scrubbed clean and disinfected with a solution of bleach and water.
- Tall plants need a wide, heavy pot for support.

**OBJECTIVE 4**

1, 3, 6, 7

**OBJECTIVE 5**

Answer must include the following points:

- Plants are top-heavy or too large for the current pot
- Growth slows down
- Plant needs more frequent watering
- Plant has become rootbound

**OBJECTIVE 6**

Refer to the Practical Test for Job Sheet 1.

**OBJECTIVE SHEET**

# INTRODUCTION TO EVERGREENS

## XVII

**INTRODUCTION**

The term *evergreen* is often associated with needle-leaved evergreens such as pines, spruces, and firs, whose boughs are often decorated at Christmas time or used to make holiday wreaths. But evergreens, both needle-leaved and broad-leaved, are also commonly used in landscapes and planted as ground covers, screens, or windbreaks. Because evergreens don't lose their leaves, they can provide privacy and beauty the year round. Nursery workers and landscapers must know the growth habits of evergreens so they can make the correct decision when selecting a plant and determining where it should be planted.

**UNIT OBJECTIVE**

After completing this unit, the student should be able to identify evergreen forms and leaf types, list landscape uses, and select the appropriate evergreen for a given landscape situation. The student will demonstrate these competencies by completing assignment sheets and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with evergreens to their correct definitions.
2. List features used to identify evergreens.
3. Describe parts of a leaf of a broad-leaved evergreen.
4. Describe types of leaves associated with broad-leaved evergreens.
5. Label types of leaves associated with narrow-leaved evergreens.
6. Describe common evergreen leaf arrangements.
7. Describe types of flowers on a broad-leaved evergreen.
8. Label evergreen plant forms.
9. Select from a list qualities to consider when selecting an evergreen for a landscape.
10. List landscape uses for evergreens.

11. Select true statements regarding narrow-leaved and broad-leaved evergreens. (Assignment Sheet 1)

12. Recommend evergreens for various landscape situations. (Assignment Sheet 2)

## SUGGESTED ACTIVITIES

## INTRODUCTION TO EVERGREENS XVII

### PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Gather books, catalogs, pamphlets, charts, and posters that deal with evergreens. (See Suggested Resources).
- Arrange for guest speakers from a local nursery, garden center, or landscaping company to talk to the class about use of evergreens in landscaping and evergreens that are popular in the region.

  NOTE: Supply guest speakers with the objective sheet, information sheet, and any other components you want them to cover.
- Arrange for a field trip to a park, neighborhood, or arboretum where evergreens can be seen. A list of public gardens and arboretums in Oklahoma and vicinity is provided in Unit I, "Introduction to Horticulture."

### DELIVERY

**Objectives 1 through 8**

- Use Information Sheet, Objective 1, to discuss terms and definitions associated with evergreens; show students examples of those terms.
- Use Information Sheet, Objectives 2 through 8, to discuss features used to identify evergreens, parts of a leaf, types of leaves, leaf arrangements, types of flowers, and plant forms.
- Use Supplement 1 to discuss the meanings of common botanical names. Relate those names to plants in Supplement 2 or plants native to your area. Have students complete Activity Sheet 1.

- Show students photographs of various plant forms and leaf and flower types; have them go through plant books and publications to pick out examples of the various forms.
- Take students on a field trip to an arboretum, park, or nursery to point out examples of the various evergreen plant forms.
- Go through Supplement 2 and discuss the plant form of each evergreen; discuss the leaf and flower types of each evergreen in the handout.

**Objectives 9 and 10**

- Use Information Sheet, Objectives 9 and 10, to discuss qualities to consider when selecting an evergreen for a landscape and landscape uses for various forms of evergreens.
- Visit gardens, parks, and other landscaped areas to determine how and why landscapers selected the plants for those sites. If possible, find the landscaping or architectural firm for that particular site and invite that person to discuss the plant selection process.
- Ask students to evaluate the landscaping of their residences; ask them what plants they would add or remove from the area, using some of the information supplied in Supplement 2.

## APPLICATION

**Objectives 11 and 12**

- Student Supplement 3, the plant hardiness zone maps for the United States and Oklahoma.
- Discuss the various hardiness zones within Oklahoma and have students go through Supplement 2 to match plants to their hardiness zones.
- Show students examples of the plants described in Supplement 2; if desired, you can test them over identification of these plants by using slides (see Suggested Resources).
- Have students complete Assignment Sheets 1 and 2.

## EVALUATION

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *4-H Horticulture Identification*, No. VT100, 1 hour, 58 minutes; Oklahoma State University, 1988. This 9-part video is geared toward 4-H volunteer leaders and 4-H agents, but can effectively be used as a general interest plant identification tool. Part 1 covers narrow-leaved evergreens and Part 2 covers broad-leaved evergreens. 4-H Horticulture Identification Card available to use when watching the tape. Available from Oklahoma State University Agricultural Cooperative Extension Centers or Oklahoma State University Agricultural Information Library, 111 PIO, Oklahoma State University, Stillwater, OK 74078.
- *Plant Identification Slide Sets* (Nos. 1, 2, 3, and 4); 50 color slides in each set—200 slides total. Available from: Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407; 800-235-4146 or 805-546-2295.

  **NOTE:** Also available from the above address is *The Backpocket Guide to Ornamental Plants* (handbook).
- *Planting Techniques Part I: Trees and Shrubs*. VHS video. Discusses how successful growth and development of newly installed landscape plants depends on proper plant selection, correct site preparation, use of appropriate planting techniques, and proper follow-up care. Topics include plant selection, site selection, containerized woody plants, planting

a container-grown pear tree, staking trees, bare root trees and shrubs, and balled and burlapped plants. Available from Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407; 1-800-235-4146.

**Computer software**

- *Evergreen Trees and Shrubs*, *Selecting Trees for The Landscape*, *Ortho's Computerized Gardening*. Software for IBM or Apple available from: AAVIM, 120 Driftmier Engineering Center, Athens, GA 30602; 404-542-2586

**Publications**

- American Association of Nurserymen (AAN) brochures available from AAN Member Services, 1250 I Street, N.W., Suite 500, Washington, D.C. 20005; 202-789-2900. Brochures include: *How to Use, Select, and Register Cultivar Names*, *Inspection Guide for Landscape Planting*, *Living Screens for North America*, *Special Trees for Special Places*.

## UNIT REFERENCES

- Dirr, Michael. *All About Evergreens*. San Francisco: Chevron Chemical Company, 1984.
- Mitchell, Paul E. *Coniferous Evergreens (Cedars) Selection, Care and Planting*. Circular E-878. Stillwater, Oklahoma: Cooperative Extension Service, Division of Agriculture, Oklahoma State University. n.d.
- Mitchell, Paul E. *Plant Science (Landscape Plant and Herbarium Card Reference*. Stillwater, Oklahoma: Cooperative Extension Service, Oklahoma State University. n.d.
- Newton, Deborah and Steve. *Landscape Management: Field Supervisor*. Stillwater, Oklahoma: The Mid-America Vocational Curriculum Consortium, Inc., 1989.
- Reiley, H. Edward and Carroll L. Shry, Jr. *Introductory Horticulture*. Albany, New York: Delmar Publishers Inc., 1988.
- Robinette, Gary O. *Evergreen Form Studies*. New York, New York: Van Nostrand Reinhold Company Inc., 1983
- Tyznik, David J. *Using Coniferous Evergreens in a Landscape*. VAS 5022. Illinois: University of Illinois, Vocational Agriculture Service.

- Whitcomb, Carl E., *Know It and Grow It IIM*. Stillwater Oklahoma: Lacebark Publications, 1983.

## INFORMATION SHEET | INTRODUCTION TO EVERGREENS | XVII

**OBJECTIVE 1**

**Match terms associated with evergreens to their correct definitions.**

- **Aril**—A cone with a fleshy seed coat instead of scales

  EXAMPLE: Found on yews

- **Botanical name**—Latin identification of plant materials divided into genus and species

  NOTE: See Supplement 1.

- **Bract**—A modified leaf at the base of a flower or belonging to a cluster of flowers

- **Broad-leaved evergreen**—Evergreen with wide leaves

  EXAMPLES: Southern Magnolia, American Holly

- **Catkin**—A delicate, scaly-bracted, usually drooping spike of flowers

  EXAMPLE: Male flowers on oaks

- **Conifer**—Plant that bears cones

  NOTE: Not all conifers are evergreens. For example, the Bald Cypress is deciduous.

- **Cultivar**—A cultivated variety of plant that will retain its distinguishing features when reproduced

- **Dormant**—Not actively growing, but capable of resuming growth when environmental conditions become favorable

- **Evergreen**—Plant that keeps its foliage year round

- **Fascicle**—Bundle or sheath that holds pine needles

- **Hardiness**— The ability of a plant to survive in cold temperatures

  NOTE: The U.S. Department of Agriculture has divided the country into hardiness zones of 10-degree increments. Plants are rated according to hardiness. See Supplement 3.

- **Narrow-leaved evergreen**—Evergreen with narrow or needle-like leaves (Supplement 2)

  EXAMPLES: Juniper, pine

- **Specimen plant**—Any plant displayed to its best advantage either alone or in multiple plantings

**OBJECTIVE 2** **List features used to identify evergreens.**

- Flower type (conspicuous or inconspicuous)

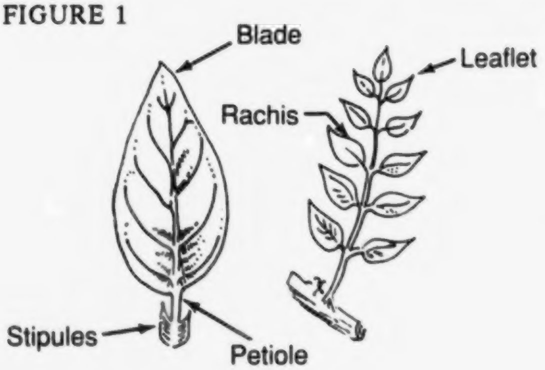
  **NOTE:** Most narrow-leaved evergreens have inconspicuous flowers.

- Fruit type
- Leaf shape and arrangement
- Stem type
- Bark
- Plant shape (form)

**OBJECTIVE 3** **Describe parts of a leaf of a broad-leaved evergreen.**

- **Stipules**—Secondary growth at the base of a petiole
- **Petiole**—Stalk at the base of a leaf (leaf stem)
- **Blade**—Expanded, flattened portion of a leaf, attached to the petiole
- **Rachis**—Central stem of compound leaves
- **Leaflet**—A single division of a compound leaf

FIGURE 1



**OBJECTIVE 4**

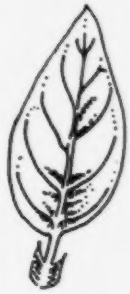
**Describe types of leaves associated with broad-leaved evergreens.**

NOTE: Whenever possible, examples are listed in Supplement 3.

- Simple—Leaf that is one solid piece; undivided

EXAMPLE: Frasers Photinia

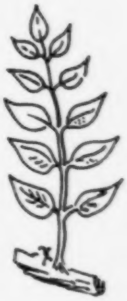
FIGURE 2



- Pinnately compound—Leaf with leaflets arranged opposite each other along the rachis

EXAMPLE: Oregon Grape (found in Zone 5)

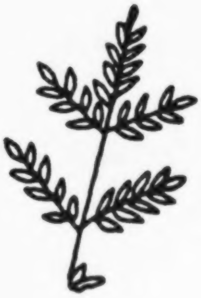
FIGURE 3



- Bi-pinnately compound (twice pinnate)—Leaf with leaflets that are also compound or divided

  EXAMPLE: Nandina

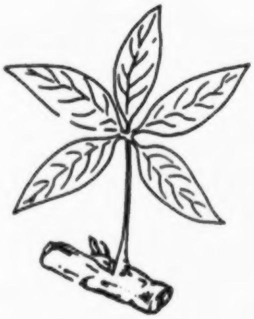
  FIGURE 4



- Palmately compound—Leaf divided into sections so that it appears like fingers on a hand

  EXAMPLE: Japanese Fatsia or Windmill Palm (found in Zone 8)

  FIGURE 5

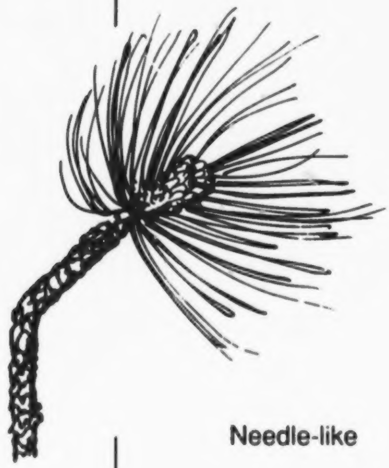


**OBJECTIVE 5**

**Label types of leaves associated with narrow-leaved evergreens.**

EXAMPLE: Pine

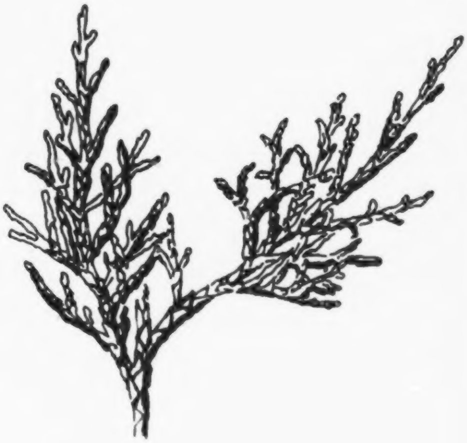
FIGURE 6



Needle-like

EXAMPLE: Pfitzer Juniper

FIGURE 7



Scale-like

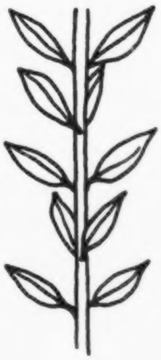
**OBJECTIVE 6**

**Describe common evergreen leaf arrangements.**

- Opposite—Directly across from each other

  EXAMPLE: English or Common Boxwood

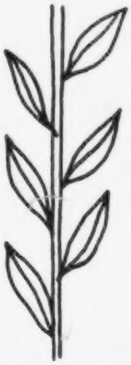
  FIGURE 8



- Alternate—Found at different levels along a stem

  EXAMPLES: Holly

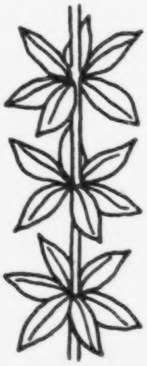
  FIGURE 9



- Whorled—An arrangement of three or more leaves radiating from a node

  EXAMPLES: Japanese Pittosporum or Mock Orange (found in Zone 8)

  FIGURE 10



**OBJECTIVE 7** **Describe types of flowers on a broad-leaved evergreen.**

**NOTE:** Most needle-leaved evergreens have inconspicuous flowers.

- Conspicuous—Prominent, showy

  EXAMPLES: Azelia (broad-leaved evergreen)

- Inconspicuous—Insignificant, not readily seen

  EXAMPLES: Oriental Arborvitae (needle-leaved evergreen); English or Common Boxwood (broad-leaved evergreen)

**OBJECTIVE 8**

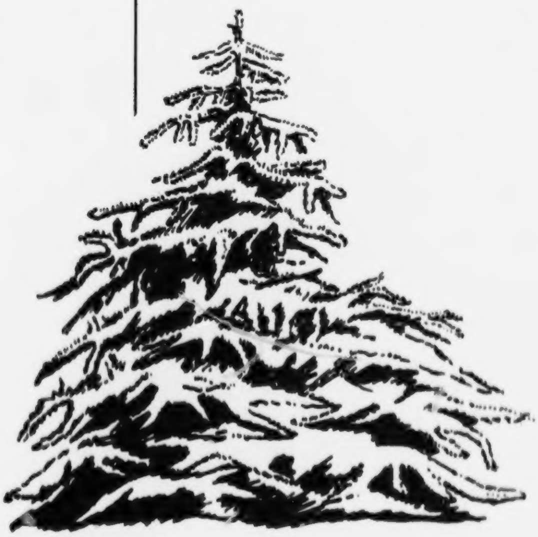
**Label evergreen plant forms.**

- Narrow-leaved evergreens

Upright, conical,
central leader tree

EXAMPLE: Colorado Blue Spruce

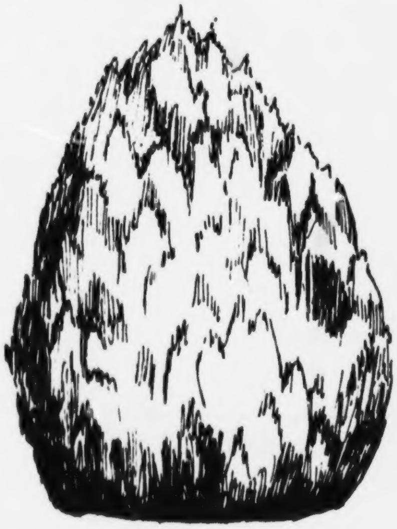
FIGURE 11



Upright, semiconical,
multiple trunk tree

EXAMPLE: Oriental Arborvitae

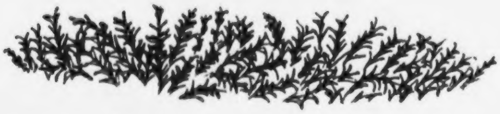
FIGURE 12



- Creeping shrub or ground cover

EXAMPLE: Creeping junipers juniper

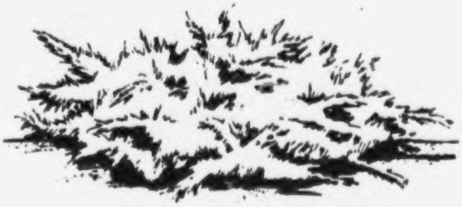
FIGURE 13



- Spreading or mounded shrub

EXAMPLE: Ajuga Chinese

FIGURE 14

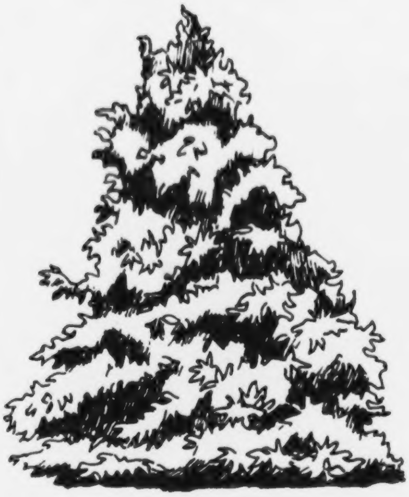


- Broad-leaved evergreens

Upright, conical, central leader

EXAMPLE: Southern Magnolia

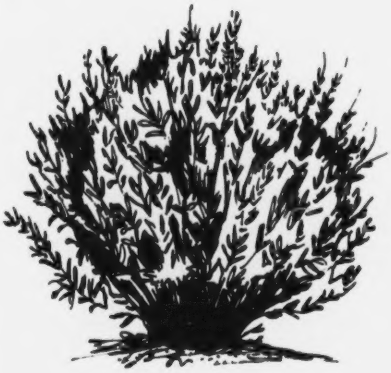
FIGURE 15



Upright, semiconical, multiple trunk

EXAMPLE: Frasers Photinia

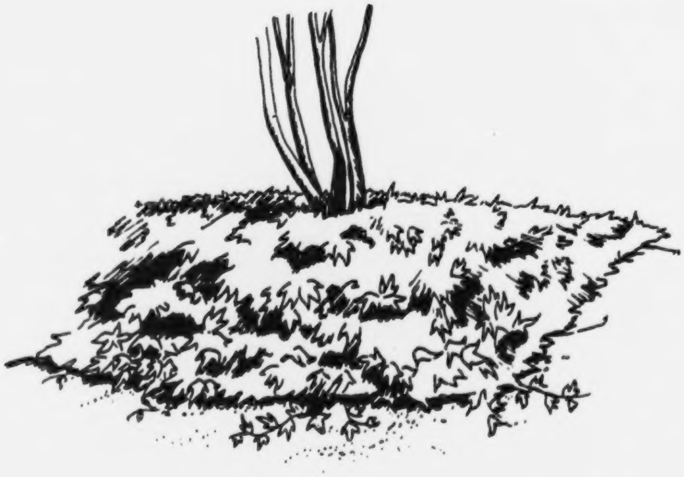
FIGURE 16



- Creeping (or ground cover)

  EXAMPLE: Mugo Pine

  FIGURE 17



**OBJECTIVE 9**

**Select from a list qualities to consider when selecting an evergreen for a landscape.**

- Climate (Hardiness)
- Color
- Texture

  NOTE: Texture is important in planning pleasing plant combinations.
- Disease and insect problems
- Exposure (sun, shade, etc.)
- Growth rate
- Size (height and spread)

  NOTE: Plants should be spaced according to their mature or controlled size when planting.
- Soil requirements

**OBJECTIVE 10** **List landscape uses for evergreens.**

Evergreen ground cover (low, creeping)

- Plant in front of buildings, along walks, and in rock gardens
- Plant in front of larger shrubs
- Provide good erosion protection; use on slopes or drape over walls
- Plant to add depth and variety to landscape

EXAMPLES: Creeping junipers (narrow-leaved evergreen), Ajuga (broad-leaved evergreen)

Spreading and small upright evergreens

- Provide screen for privacy and to hide unsightly views
- Can be pruned, used as hedges
- Can be used as backdrops for flower beds and low plantings
- Uprights (pyramidal and columnar) can be used as accent plants

EXAMPLES: Rocky Mountain Juniper (narrow-leaved evergreen), Nandina (broad-leaved evergreen)

Evergreen trees

- Can be used as tall screens, windbreaks
- Can be used to frame a view
- Should be used sparingly since they are often used as specimen or accent plants
- Should not be crowded; most need 12 to 25 feet to spread

EXAMPLES: Austrian Pine (narrow-leaved evergreen), Southern Magnolia (broad-leaved evergreen)

## PARTS OF A PLANT'S BOTANICAL NAME

- Genus—The first name in a botanical name; always capitalized and italicized (or underlined)
- Species—The second name in a botanical name; not capitalized but is also italicized (or underlined)
- Cultivar (Cultivated + variety)—Named variety of a plant; listed after the species name; capitalized and is surrounded by single quotation marks

EXAMPLE:

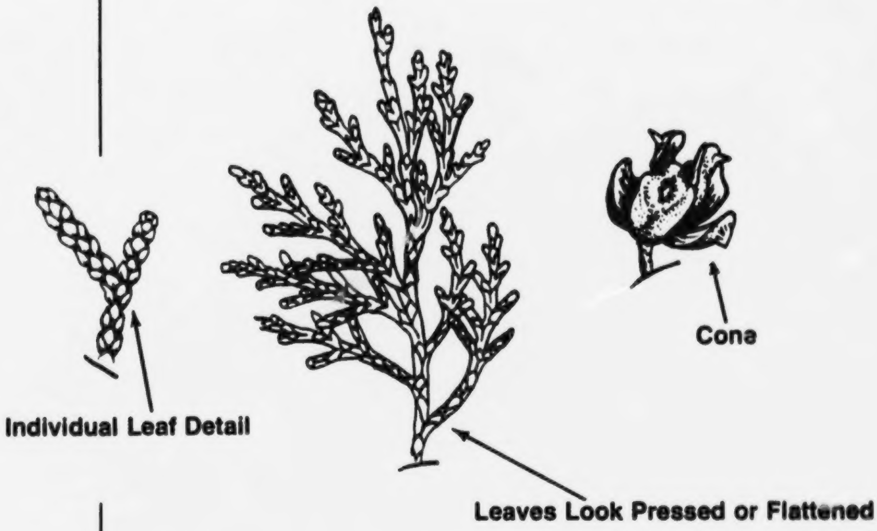
| | |
|---|---|
| Common name: | Chinese Juniper |
| Botanical name: | Juniperus chinesis |
| Genus: | *Juniprus* |
| Species: | *chinesis* |
| Cultivar: | 'Blue Vase,' 'Hetzii' |

Meanings of common botanical names

## NARROW-LEAVED EVERGREENS AND THEIR CHARACTERISTICS

FIGURE 1

### Arborvitae, Oriental

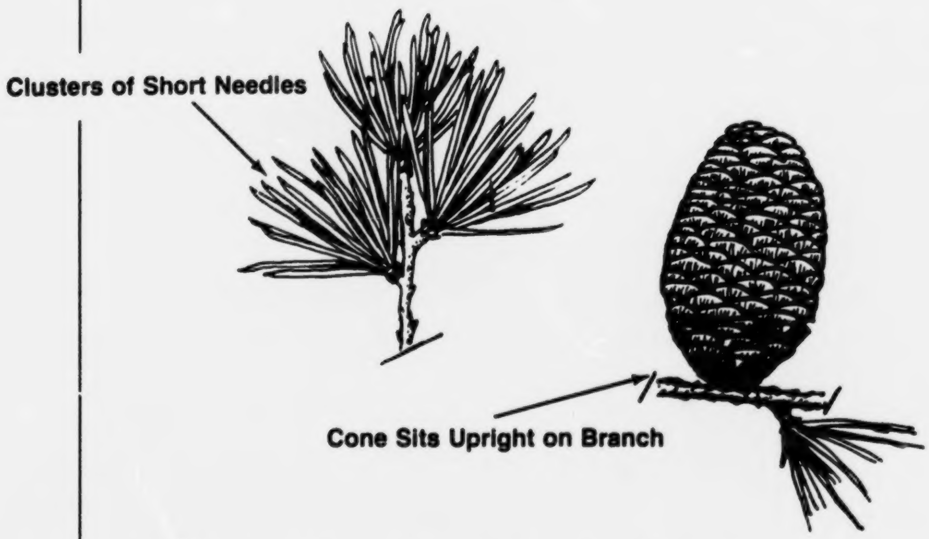


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Arborvitae, Oriental
Botanical name: *Platycladus orientalis*
Hardiness zone: 5
Exposure: Sun
Size: Height 15-25 feet; spread 10-15 feet
Form: Upright, semi-conical, many trunks from ground level
Color: Medium to light-green foliage; inconspicuous flower in spring; small woody cone in fall and winter
Texture: Medium to coarse
Soil: Tolerates almost any soil and site. Prefers rich, moist soils.
Pest problems: Bagworms, aphids, spider mites.
Landscaping comments: Often becomes overgrown after 12-15 years; can be maintained as a sheared hedge

FIGURE 2

## Cedar, Atlas

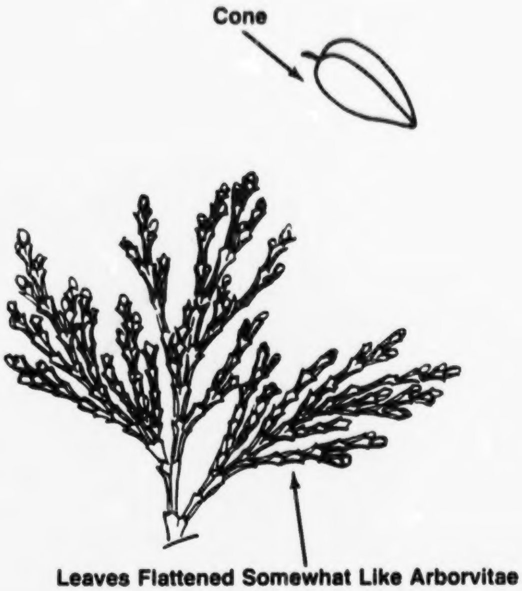

Clusters of Short Needles
Cone Sits Upright on Branch

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Cedar, Atlas
Botanical name: *Cedrus atlantica*
Hardiness zone: 6
Exposure: Sun or part shade
Size: Height 25-50 feet; spread 15-20 feet
Form: Conical, central leader
Color: Dark green foliage; inconspicuous catkin in spring; cones
Texture: Fine
Soil: Medium to good drainage; medium to fairly high soil fertility
Pest problems: None serious
Landscaping comments: Slow to medium growth rate; should be used with caution in a landscape setting; a striking specimen plant; wide-spreading, formal

FIGURE 3

## Cedar, Incense

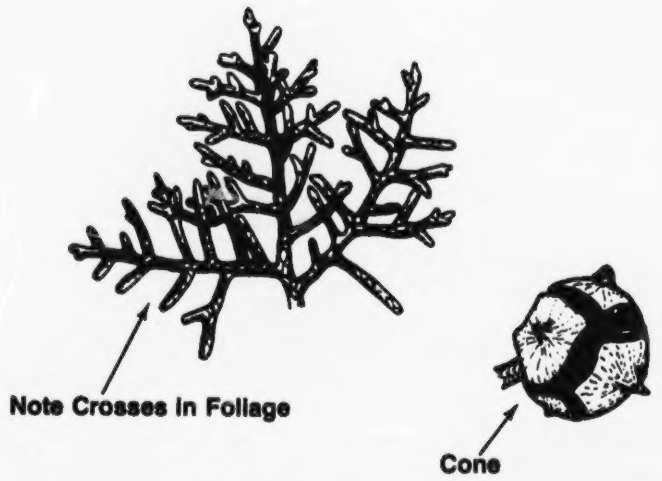


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Cedar, Incense
Botanical name: *Calocedrus decurrens*
Hardiness zone: 5
Exposure: Sun or part shade
Size: Height 20-40 feet; spread 15-20 feet
Form: Upright, conical
Color: Dark green; inconspicuous spring flower; cone in fall
Texture: Medium to slightly coarse
Soil: Medium to good drainage and fertility
Pest problems: Bagworms occasionally
Landscaping comments: Beautiful, high-quality plant; good landscape potential for Oklahoma

FIGURE 4

## Cypress, Arizona

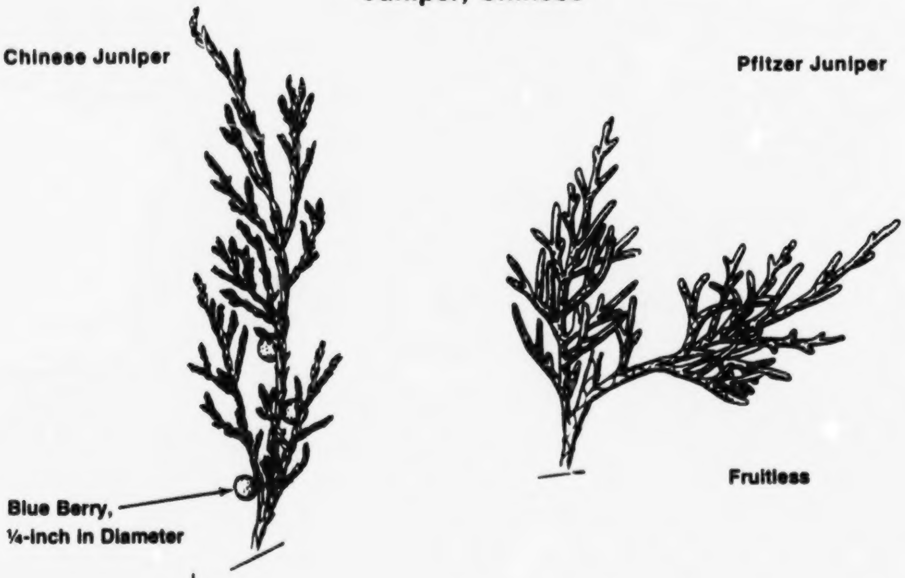


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Cypress, Arizona
Botanical name: *Cupressus arizonica*
Hardiness zone: 7
Exposure: Sun or part shade
Size: Height 25-50 feet; spread 12-25 feet
Form: Conical, central leader (tree or shrub)
Color: Silver gray foliage and cone; inconspicuous spring flower
Texture: Fine
Soil: Good drainage; low fertility
Pest problems: Juniper blight and bagworms
Landscaping comments: Medium to fast growth rate; requires plenty of growing space unless heavily pruned; budded cypress are subject to blowing over with wet soil and high wind conditions

FIGURE 5

**Juniper, Chinese**

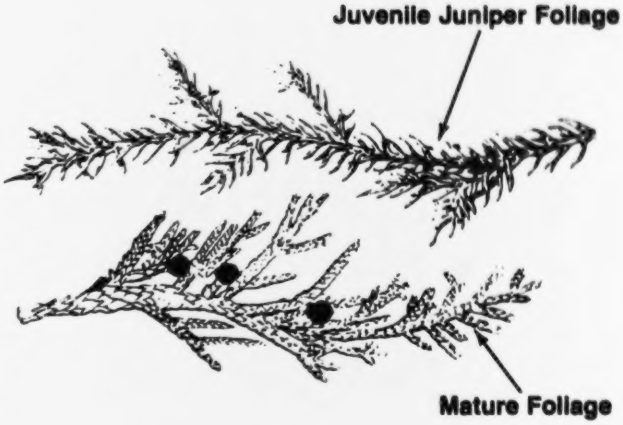

Chinese Juniper
Pfitzer Juniper
Fruitless
Blue Berry,
¼-inch in Diameter

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Juniper, chinese
Botanical name: *Juniperus chinensis*
Hardiness zone: 3-5, depending on cultivar
Exposure: Full sun
Size: Height 10-30 feet; spread 10-20 feet
Form: Upright pyramidal
Color: Medium green foliage; light blue berry in fall; inconspicuous spring flower
Texture: Medium
Soil: Medium drainage; medium fertility
Pest problems: Bagworms, spider mites; blight resistant
Landscaping comments: Fairly fast growth rate; durable; good for hot locations; many cultivars, including Pfitzer juniper, 'Blue Vase,' 'Hetzii'

FIGURE 6

## Junipers, Creeping

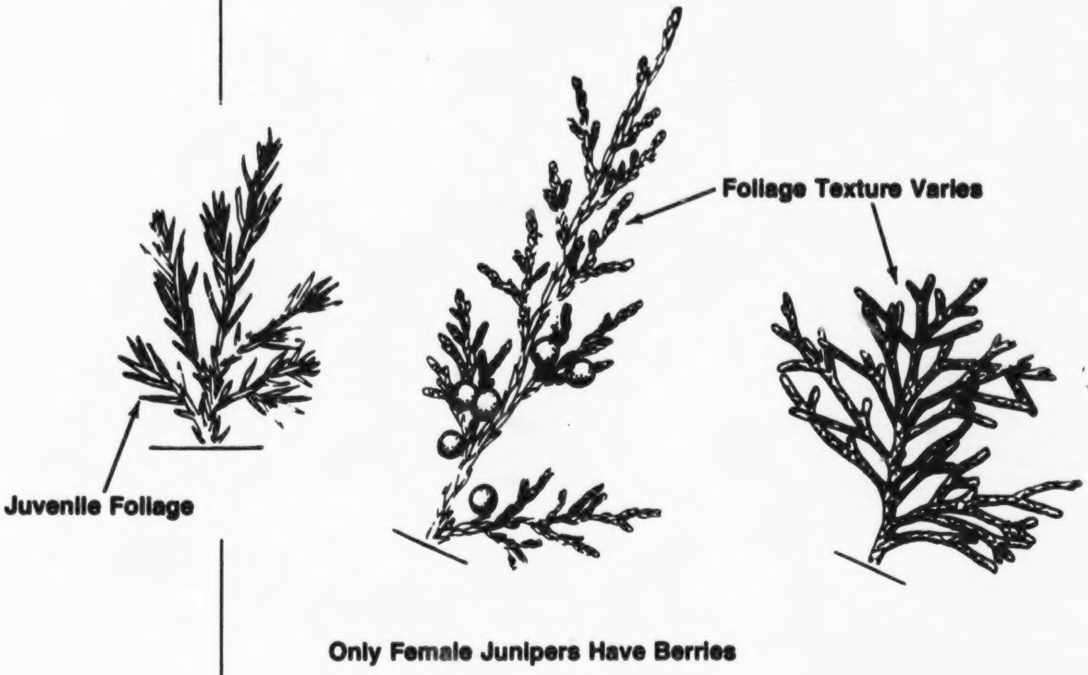


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Creeping Juniper
Botanical name: *Juniperus species*
Hardiness zone: 2
Exposure: Full sun or part shade
Size: Height 6-12 inches; spread 5-8 feet
Form: Prostrate, creeping
Color: Varies, blue to green
Texture: Medium
Soil: Medium to good drainage; medium fertility
Pest problems: Spider mites, Juniper scale
Landscaping comments: Medium growth rate; suitable for rock garden and ground cover use; many cultivars: 'Bar Harbor,' 'Blue Rug,' Shore Juniper, Andorra Creeping Juniper

FIGURE 7

## Red Cedar, Eastern

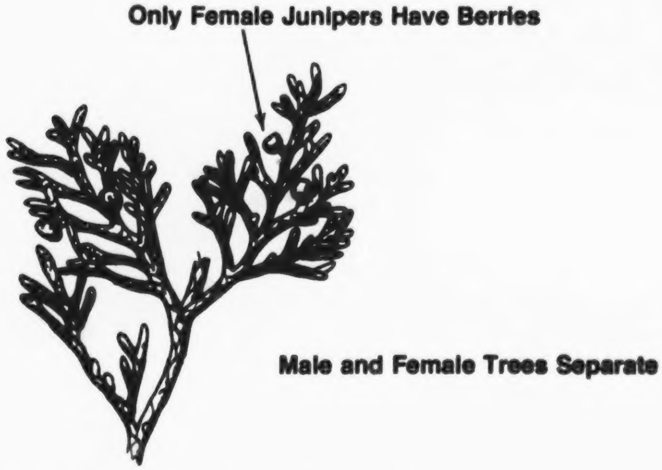

Foliage Texture Varies
Juvenile Foliage
Only Female Junipers Have Berries

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Red Cedar, Eastern
Botanical name: *Juniperus virginiana*
Hardiness zone: 2
Exposure: Sun
Size: Height 20-40 feet; Spread 10-30 feet
Form: Conical, central leader
Color: Dark green in summer; rusty colored in winter; bluish fruit in mid-summer; inconspicuous male flower
Texture: Fine
Soil: Good to medium drainage; medium fertility; hilltop to bottomland
Pest problems: Bagworms, juniper scale, alternate host for cedar apple rust
Landscaping comments: Very diverse species; responds well to pruning, shearing

FIGURE 8

## Juniper, Rocky Mountain

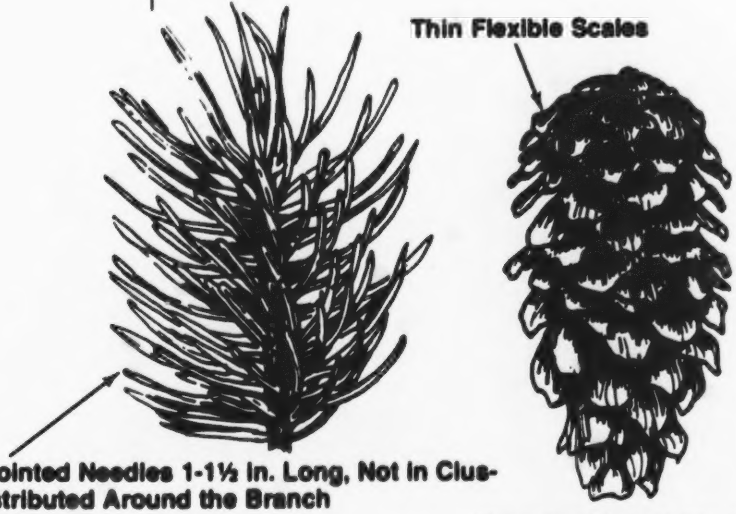

Only Female Junipers Have Berries
Male and Female Trees Separate
Foliage May be Blue or Green, Depending on Cultivar

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Juniper, Rocky Mountain
Botanical name: *Juniperus scopulorum*
Hardiness zone: 4
Exposure: Sun
Size: Height 15-30 feet; spread 6-12 feet
Form: Conical, central leader trunk
Color: Varies with variety—Gray-green, silver-gray, blue-gray; small blue berry in fall and winter; inconspicuous spring flower
Texture: Medium
Soil: Wide range of soils; good drainage essential
Pest problems: Bagworms, cedar apple rust
Landscaping comments: Medium to slow growth rate; durable for dry conditions; Cultivars include 'Wichita Blue,' 'Table-top Blue'

FIGURE 9

## Spruce, Colorado Blue



Thin Flexible Scales

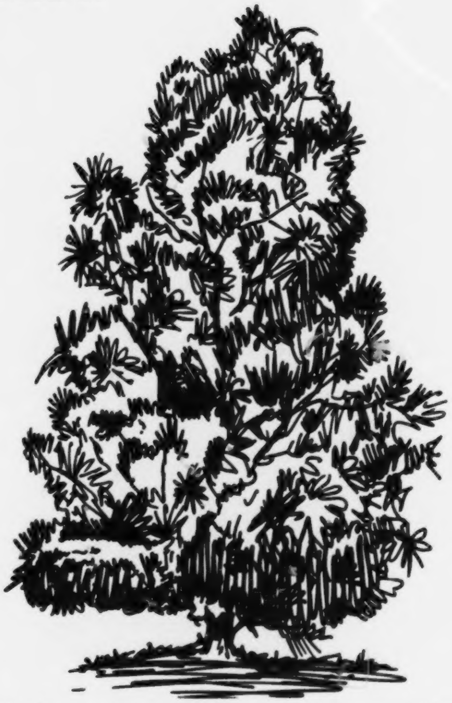
Sharp-pointed Needles 1-1½ In. Long, Not in Clusters, Distributed Around the Branch

Drooping Cone 2-4 In. Long, Seldom Seen Except in Tops of Old Trees

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Spruce, Colorado Blue
Botanical name: *Picea pungens*
Hardiness zone: 2
Exposure: Sun to part shade
Size: Height 10-30 feet; spread 10-20 feet
Form: Upright, pyramidal to columnar
Color: Green to blue green
Texture: Fine
Soil: Loam to sandy loam; cool soil; good drainage; medium to low fertility
Pest problems: None serious
Landscaping comments: Do not crowd; very formal, attractive; can dominate landscape; plant on north side of buildings to protect tree from southwest winds

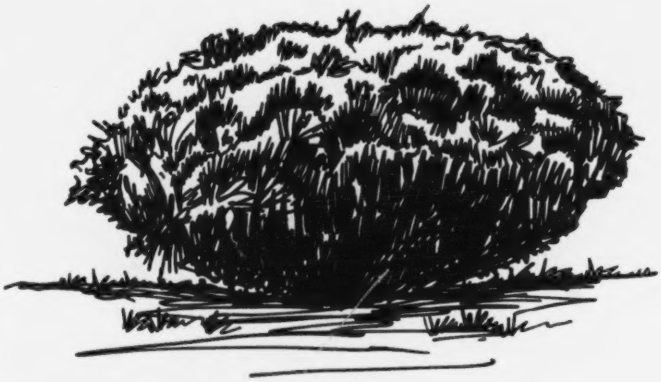
FIGURE 10



Used with permission of Lacebark Publications, Stillwater, OK

Common name: Pine, Austrian
Botanical name: *Pinus nigra*
Hardiness zone: 4
Exposure: Sun
Size: Height 60-80 feet; spread 30-40 feet
Form: Pyramidal tree
Color: Dark green; cone
Texture: Medium
Soil: Loam to sandy loam to poor and rocky, but with excellent drainage; will grow in rather moist soils
Pest problems: Twig blight, needle blight
Landscaping comments: Slow grower, very durable after established, will tolerate salt, wind, and drought; good background tree for landscape.

FIGURE 11



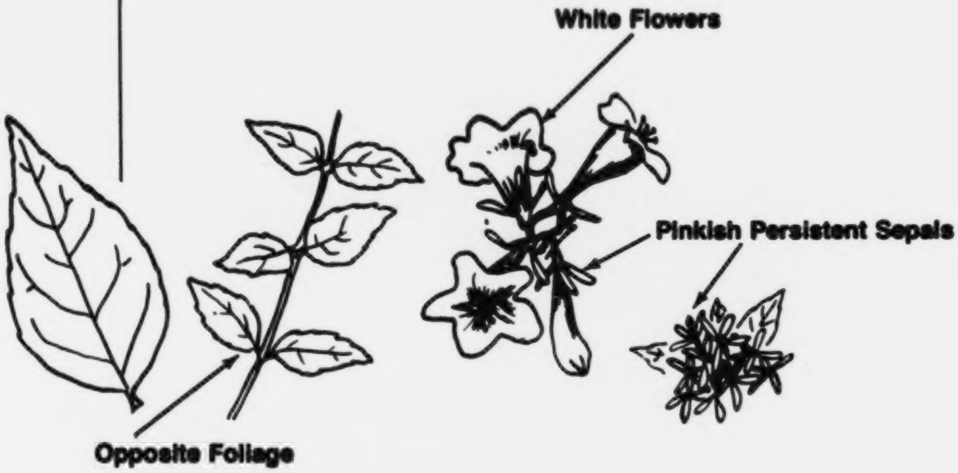
Used with permission of Lacebark Publications, Stillwater, OK

Common name: Pine, Mugo
Botanical name: *Pinus mugo* 'mughus'
Hardiness zone: 3
Exposure: Sun
Size: Height 6-8 feet; spread 8-10 feet
Form: Round shrub
Color: Dark green; cone usually hidden by foliage
Texture: Medium
Soil: Needs well-drained soil
Pest problems: Pine tip moth
Landscaping comments: Slow grower; can't take extreme heat—not drought resistant; grows best in Zone 7 and northward; shearing new growth lightly will help in maintaining a tight symmetrical shrub.

# BROAD-LEAVED EVERGREENS AND THEIR CHARACTERISTICS

FIGURE 12

## Abelia, Glossy

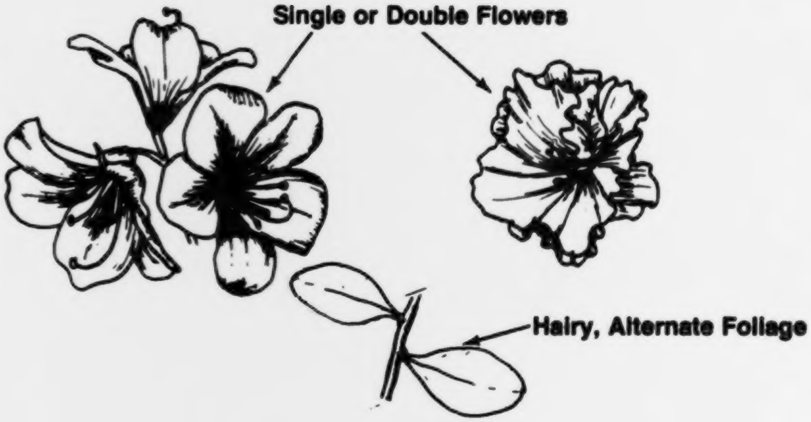


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Abelia, glossy
Botanical name: *Abelia grandiflora*
Hardiness zone: 6
Exposure: Sun or part shade
Size: Height 6-8 feet; spread 4-6 feet
Form: Semi-global; many canes from ground level
Color: Purplish-green, glossy foliage; white and pink flower in spring, summer, early fall
Texture: Medium to fine
Soil: Medium to good drainage; medium fertility with high organic content; poorly adapted to deep, sandy soils
Pest problems: None serious
Landscaping comments: Medium growth rate; use for border, or background; may be pruned or sheared into a dense hedge

FIGURE 13

## Azalea Kurume

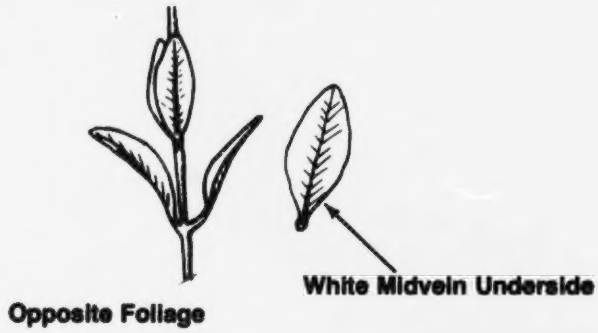


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Azalea Kurume
Botanical name: *Rhododendron x kurume*
Hardiness zone: 6, but variable
Exposure: Part shade to shade
Size: Height 3-4 feet; spread 3 feet
Form: Dense, twiggy mound
Color: Leaves dull, shiny green; small spring flowers in many colors
Texture: Medium to fine
Soil: Well drained, fertile, moist acid loam or sandy loam with high organic content
Pest problems: Lace bugs, spider mites occasionally; mushroom root rot of older plants in low vigor
Landscaping comments: Slow to moderate growth rate; high maintenance plants with special exposure and soil requirements; quickly die from too much sun or wind; when in flower, few plants rival their beauty

FIGURE 14

## Box-wood, English or Common

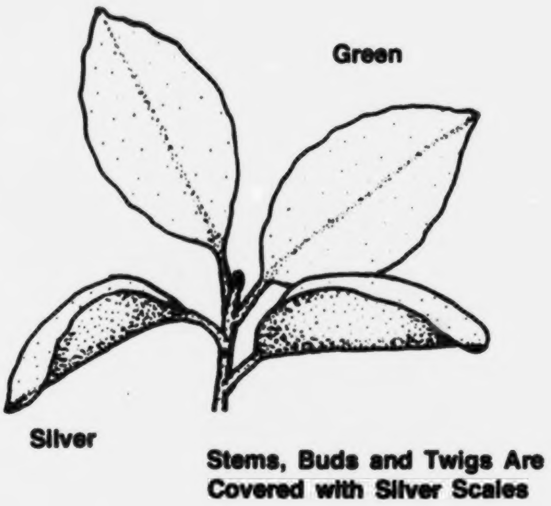


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Boxwood, English or Common
Botanical name: *Buxus sempervirens*
Hardiness zone: 5
Exposure: Part shade to shade
Size: Height 3-7 feet; spread 3-6 feet
Form: Upright globe
Color: Dark green; inconspicuous flower and fruit
Texture: Fine to medium
Soil: Good drainage; medium fertility with high organic content
Pest problems: Boxwood miner, dog urine, spider mites, nematodes, and root rot in poorly drained soil
Landscaping comments: Very slow growth rate; used for low borders and small hedge; all plant parts may be poisonous

FIGURE 15

## Elaeagnus, Silverberry or Thorny

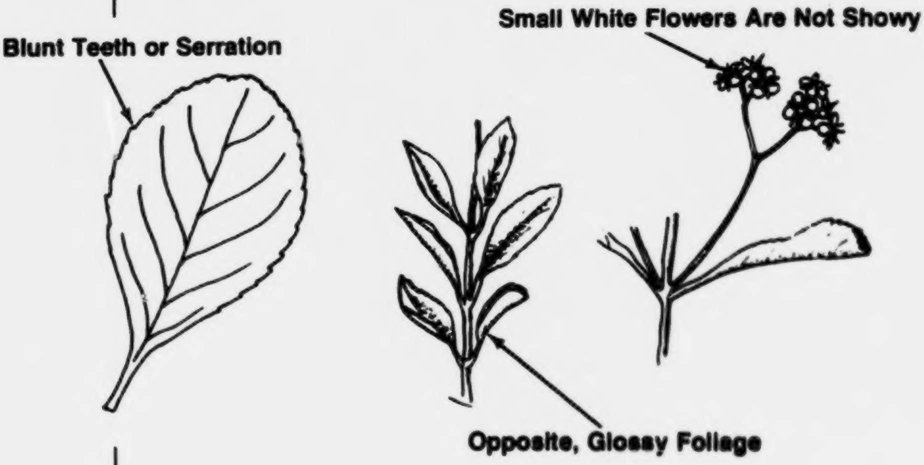


Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Elaeagnus, Silverberry or Thorny
Botanical name: *Elaeagnus pungens*
Hardiness zone: 7
Exposure: Sun to part shade
Size: Height 8-12 feet; spread 8-10 feet
Form: Semi-upright, spreading shrub
Color: Silver-gray-green foliage; inconspicuous flowers, but very fragrant
Texture: Medium
Soil: Almost any soil including poorly drained soils and hot spots
Pest problems: Spider mites occasionally
Landscaping comments: Moderate to rapid grower; needs plenty of space and requires frequent pruning in small places; attracts birds; a hardy plant by sucker and thorns may limit uses

FIGURE 16

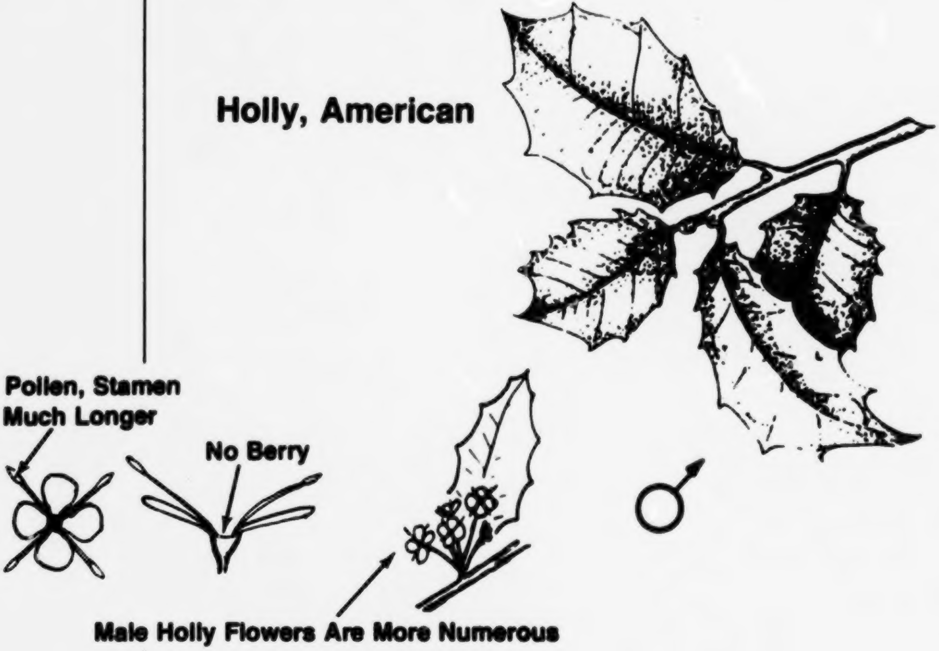
## Euonymus, Evergreen or Japanese


Blunt Teeth or Serration
Small White Flowers Are Not Showy
Opposite, Glossy Foliage

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Euonymus, Evergreen or Japanese
Botanical name: *Euonymus japonica*
Hardiness zone: 7
Exposure: Sun to part shade
Size: Height 5-7 feet; spread 3-5 feet
Form: Upright narrow shrub or leaning vine
Color: Dark green foliage; tiny white flower in early summer
Texture: Medium
Soil: Medium drainage; medium fertility with high organic content
Pest problems: Euonymus scale is serious problem; spider mite occasionally
Landscaping comments: May be sheared for low hedge, trained to lean against wall, or standard shrub; tough and durable

FIGURE 17

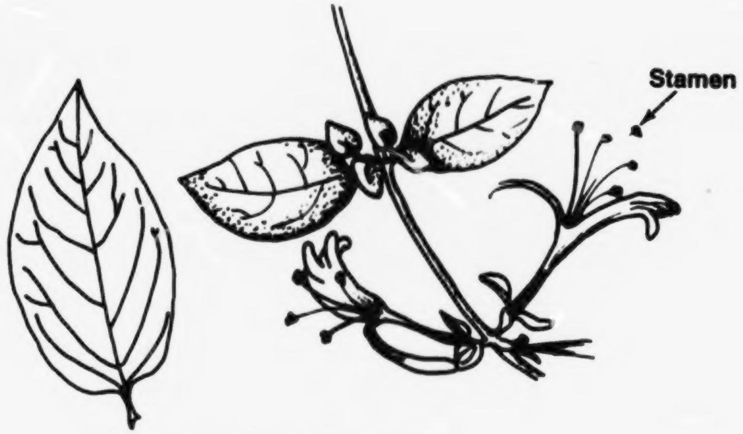

Holly, American
Pollen, Stamen Much Longer
No Berry
♂
Male Holly Flowers Are More Numerous

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Holly, American
Botanical name: *Ilex opaca*
Hardiness zone: 6
Exposure: Sun or part shade
Size: Height 15-30 feet; spread 10-20 feet
Form: Upright conical
Color: Dark green; red, yellow fruit in fall and winter
Texture: Medium to slightly coarse
Soil: Good drainage; medium fertility
Pest problems: Leaf spot, holly leaf miner, rabbits in winter
Landscaping comments: Shelter from drying winds in summer and winter; often specimen plants; also works well for background, screens, large hedges

FIGURE 18

## Honeysuckle, Purple Leafed



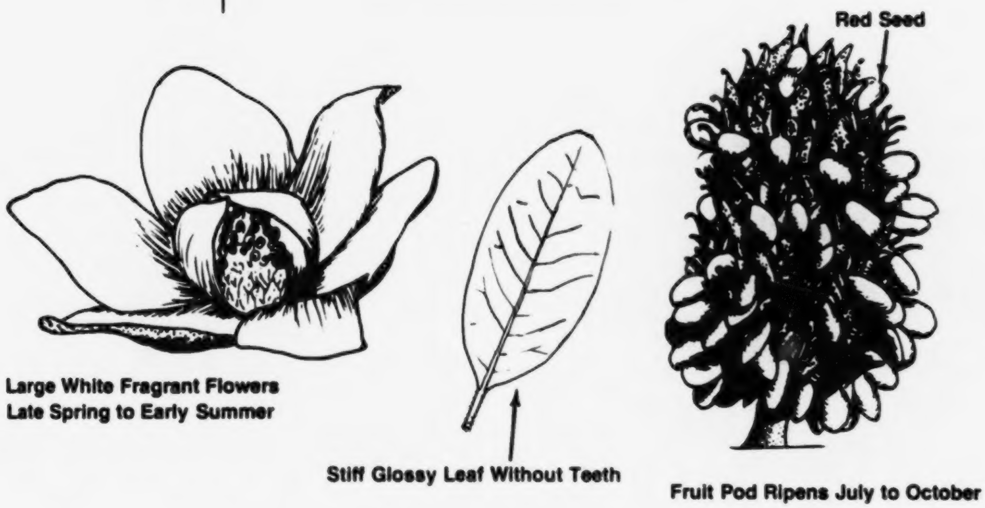
Soft Opposite Foliage

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Honeysuckle, purple-leaved
Botanical name: *Lonicera japonica*, 'Purpurea'
Hardiness zone: 4
Exposure: Sun to shade
Size: Height 2-4 feet; spread 3-5 feet
Form: Low-spreading shrubby vine to semi-trailing
Color: Bronze-green spring and summer foliage to deep purplish-green fall and winter; pinkish-maroon to white fragrant flowers
Texture: Medium
Soil: Medium drainage; medium fertility with high organic content
Pest problems: None serious
Landscaping comments: Medium to fast growth rate; can become unsightly if neglected; can be used to cover chain-link fence; good for erosion control

FIGURE 19

## Magnolia, Southern

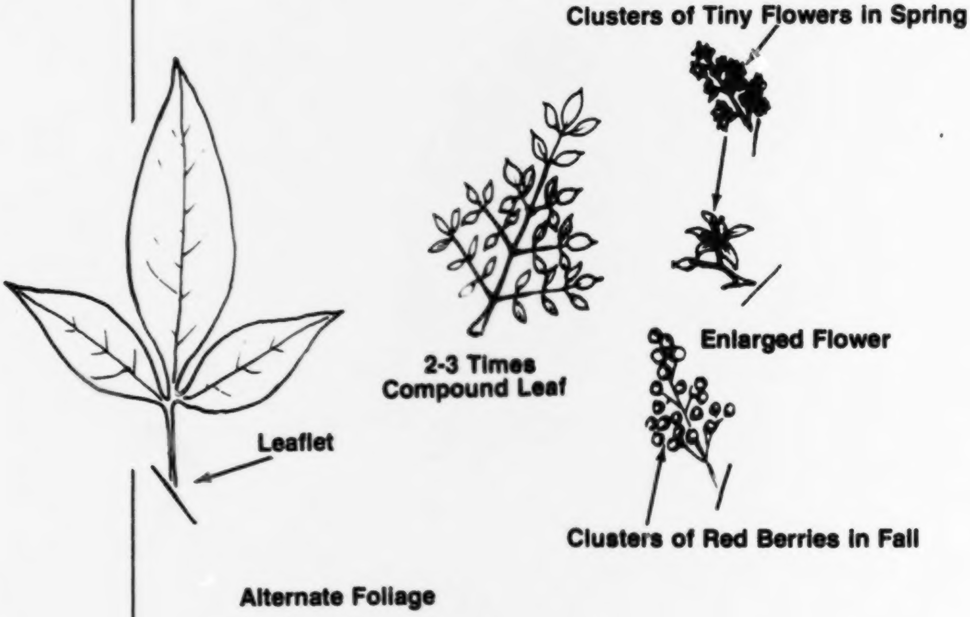

Red Seed
Large White Fragrant Flowers
Late Spring to Early Summer
Stiff Glossy Leaf Without Teeth
Fruit Pod Ripens July to October

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Magnolia, Southern
Botanical name: *Magnolia grandiflora*
Hardiness zone: 7
Exposure: Full sun or part shade
Size: Height 25-50 feet; spread 15-30 feet
Form: Conical tree, central leader trunk
Color: Medium to dark green foliage; white flower in late spring and summer; pinkish-green fruit receptacle with reddish-orange seeds in late summer and fall
Texture: Coarse
Soil: Good drainage; medium fertility with high organic content; magnesium deficiency common
Pest problems: Occasional leaf spot, sun scald; wind burn damage common.
Landscaping comments: Allow sufficient room to grow; often dominates landscape

FIGURE 20

**Nandina**

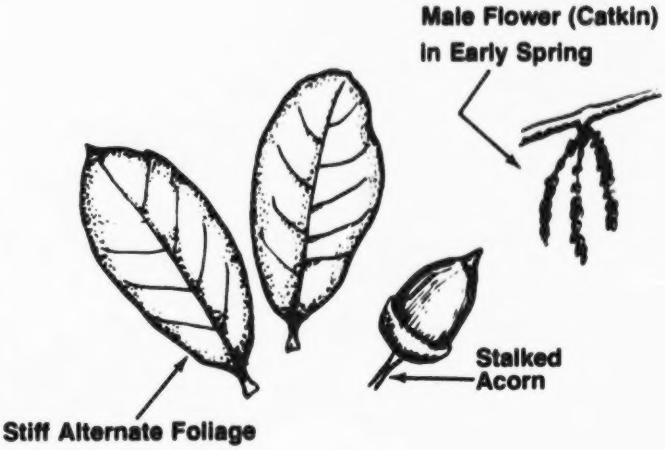

Clusters of Tiny Flowers in Spring
2-3 Times Compound Leaf
Enlarged Flower
Leaflet
Clusters of Red Berries in Fall
Alternate Foliage

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Nandina
Botanical name: *Nandina domestica*
Hardiness zone: 6
Exposure: Sun or part shade
Size: Height 5-7 feet; spread 2 1/2 to 5 feet
Form: Upright, many canes
Color: Green summer foliage, greenish-maroon or red or yellow in fall; creamy white flower in spring; red berries in late summer, fall, and winter
Texture: Medium
Soil: Tolerates even poor soils so long as they are not too hot in summer
Pest problems: One of the most disease and insect-free broad-leaved evergreen shrubs
Landscaping comments: Medium growth rate; tough, maintenance-free plant; drought resistant; does not grow well in hot areas caused by structures and concrete

FIGURE 21

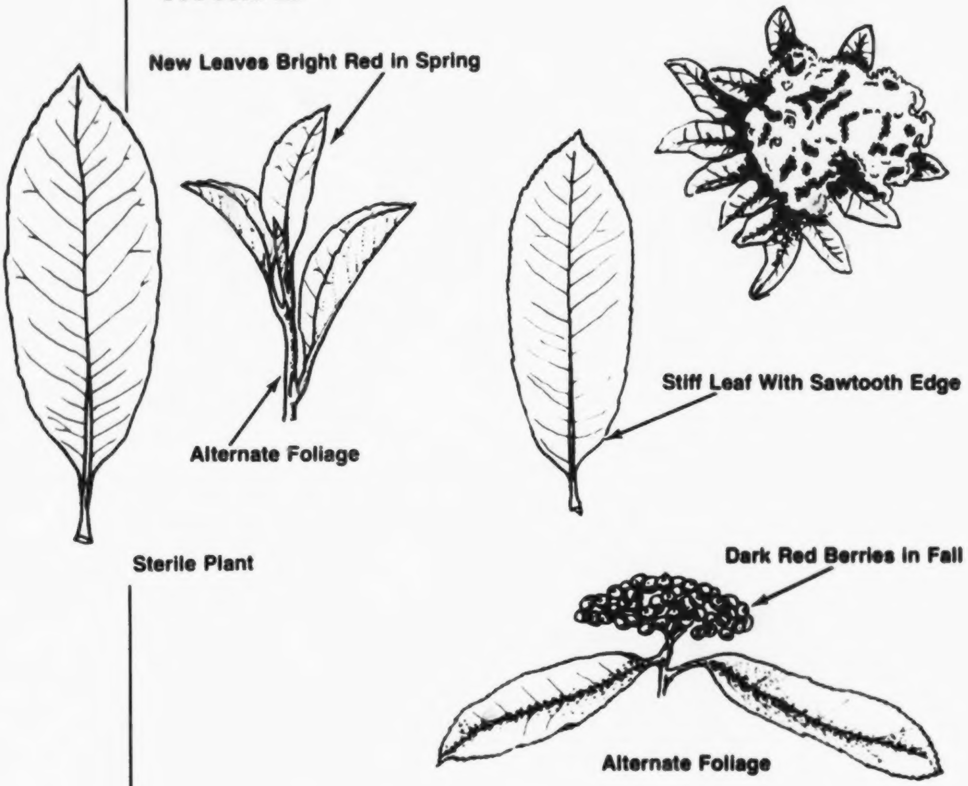
## Oak, Live



Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Oak, Live
Botanical name: *Quercus virginiana*
Hardiness zone: 7
Exposure: Sun or part shade
Size: Height 25-60 feet; spread 15-60 feet
Form: Broad oval tree with age
Color: Dark green leaves above and gray-green below; inconspicuous flower (catkin) in spring; greenish-brown acorn in fall
Texture: Medium to fine
Soil: Native to most soils; tolerates considerable drought and poor soils
Pest problems: Gall forming insects make trees unsightly; root rot of mature trees on wet sites
Landscaping comments: Very slow growth rate; remains small tree for many years; picturesque

FIGURE 22

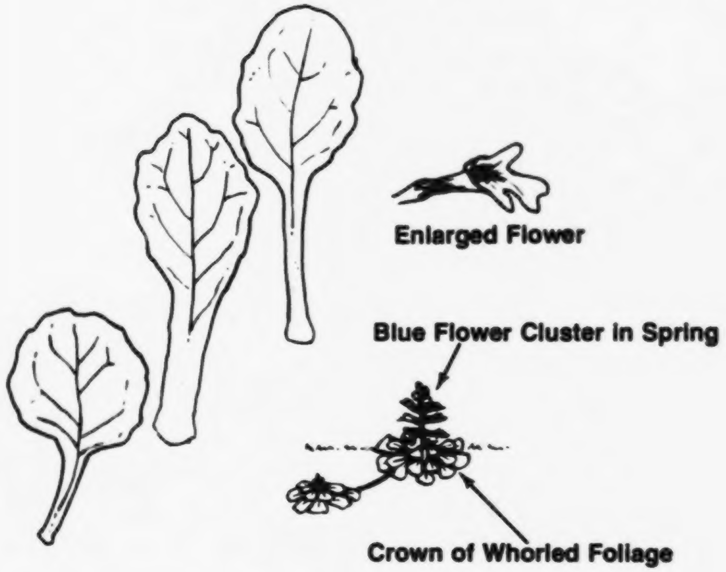

New Leaves Bright Red in Spring
Stiff Leaf With Sawtooth Edge
Alternate Foliage
Sterile Plant
Dark Red Berries in Fall
Alternate Foliage

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Photinia, Frasers
Botanical name: *Photinia x Fraseri*
Hardiness zone: 7
Exposure: Sun to partial shade
Size: Height 12-15 feet; spread 8-10 feet
Form: Upright, oval, large shrub; multi-stemmed
Color: New foliage is bright red in spring, turning green in summer; Chinese Photinia has creamy, white clusters of tiny flowers in spring and red berries in fall
Texture: Medium to coarse
Soil: Tolerates most soils as long as they are not excessively wet; not adapted to hot soils, such as planters
Pest problems: Few problems in sunny locations; leaf spot, twig blight or mildew in shady locations with poor air circulation
Landscaping comments: Allow room to grow; a good sound barrier; occasionally suffers late spring freeze damage especially when young

FIGURE 23

## Ajuga, Carpetbugle or Bugleweed

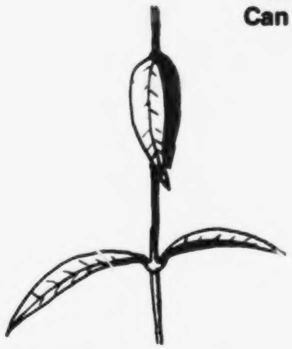


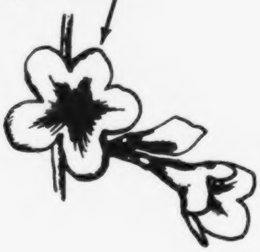
Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Ajuga, Carpetbugle or Bugleweed
Botanical name: *Ajuga reptans*
Hardiness zone: 6
Exposure: Best in partial shade to shade; tolerates morning sun
Size: Height 4-6 inches; spreads by runners like strawberry plants
Form: Ground cover
Color: Blue, white, or rose flowers in spring and green to purple foliage depending on cultivar
Texture: Coarse
Soil: Loam to clay soils are best
Pest problems: Spider mites in dry locations
Landscaping comments: Most attractive in early spring in flower and immediately following; won't tolerate foot traffic; good for rock garden or ground cover

FIGURE 24

## Carolina Yellow Jessamine

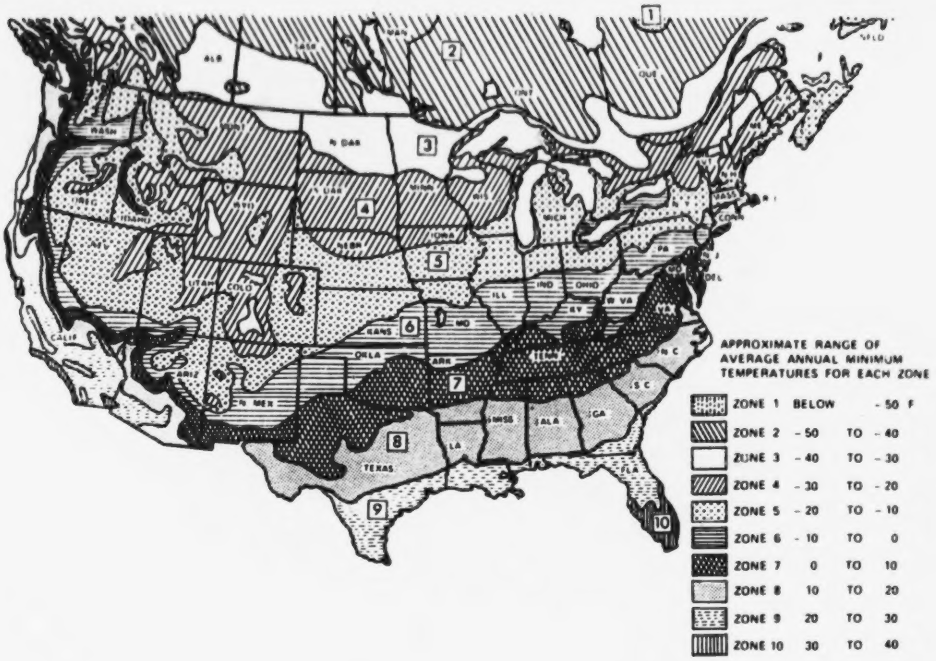



Nectar of Yellow Spring Flowers
Can Be Deadly if Eaten

Courtesy of Oklahoma State University Cooperative Extension Service

Common name: Carolina Yellow Jessamine
Botanical name: *Gelsemium sempervirens*
Hardiness zone: 7
Exposure: Sun or shade
Size: A rapid growing vine climbing by twining from 10 to 20 feet
Form: Vine; can be trained to a 3 to 4 feet shrub. Oklahoma's only flowering evergreen vine
Flower: Plant is covered with bright yellow extremely poisonous flowers in early spring. Fruit is an inconspicuous capsule
Color: Deep, glossy green opposite foliage
Texture: Medium
Soil: Good to medium soils
Pest Problems: None serious
Landscaping comments: This is one of the more poisonous landscape plants. Although all parts of the plant are poisonous, the roots and nectar are especially toxic and have caused deaths from eating or sucking the nectar. In fact, honey bees have been poisoned and honey made from the nectar is poisonous. Do not plant Carolina Jessamine in public places where children play. Tolerates wet swamp conditions and moderate drought

U.S. Plant Hardiness Zone Map


1
2
3
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5
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7
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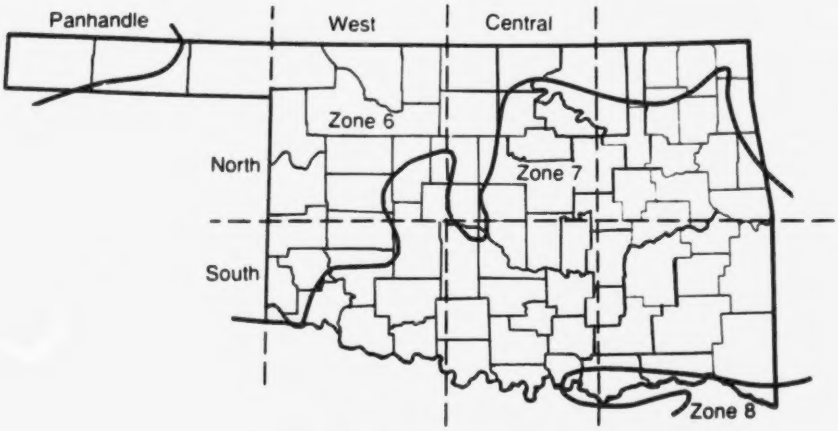
10
N DAK
IOWA
NEBR
KANS
OKLA
ILL
IND
OHIO
W VA
KY
MO
ARK
TENN
N C
S C
GA
ALA
MISS
LA
TEXAS
FLA
N MEX
ARIZ
UTAH
COLO
NEV
CALIF
WASH
IDAHO
MICH
PA
MASS
CONN
DEL
APPROXIMATE RANGE OF AVERAGE ANNUAL MINIMUM TEMPERATURES FOR EACH ZONE
ZONE 1 BELOW -50 F
ZONE 2 -50 TO -40
ZONE 3 -40 TO -30
ZONE 4 -30 TO -20
ZONE 5 -20 TO -10
ZONE 6 -10 TO 0
ZONE 7 0 TO 10
ZONE 8 10 TO 20
ZONE 9 20 TO 30
ZONE 10 30 TO 40


Panhandle
West
Central
Zone 6
North
Zone 7
South
Zone 8

Plant Hardiness Zone Map for Oklahoma

## INTRODUCTION TO EVERGREENS

NAME ______________________________ SCORE _______

**DIRECTIONS**

Answer the following questions on parts of a botanical name. Use Supplement 2 or other reference materials, if desired.

1. What is the species name of Atlas Cedar?

   ______________________________________________

2. What is the genus of Eastern Red Cedar?

   ______________________________________________

3. What is the botanical name for Colorado Blue Spruce?

   ______________________________________________

4. What is the species name of Glossy Abelia?

   ______________________________________________

5. What is the genus of Evergreen Euonymus?

   ______________________________________________

6. What is the species name of Thorny Elaeagnus?

   ______________________________________________

7. What is the meaning of the botanical name for Thorny Elaeagnus?

   ______________________________________________

8. What is the meaning of the botanical name for Glossy Abelia?

   ______________________________________________

# INTRODUCTION TO EVERGREENS

**ACTIVITY SHEET 1**

1. Atlantica
2. Juniperus
3. Picea pungens
4. Grandiflora
5. Euonymus
6. Pungens
7. Pungens—piercing, sharp-pointed
8. Grandiflora—with large flowers

**ASSIGNMENT SHEET 1**

# INTRODUCTION TO EVERGREENS

# XVII

NAME ______________________________ SCORE _______

**OBJECTIVE 11**

**Select true statements regarding narrow-leaved and broad-leaved evergreens.**

**DIRECTIONS**

Review the information in Supplement 3; then select the true statements regarding the following narrow-leaved and broad-leaved evergreens. Write "T" in front the true statements and "F" in front of false statements.

Narrow-leaved evergreens

___ 1. An Oriental Arborvitae can be maintained as a sheared hedge.

___ 2. An Atlas Cedar often has problems with cedar apple rust.

___ 3. An Incense Cedar is best suited for hardiness zone 7.

___ 4. An Arizona Cypress is conical in form and has a central leader.

___ 5. A Chinese Juniper requires full sun.

___ 6. 'Bar Harbor' is a cultivar of Creeping Junipers.

___ 7. An Eastern Red Cedar responds well to pruning and shearing.

___ 8. A Rocky Mountain Juniper can tolerate poor drainage.

___ 9. A Colorado Blue Spruce is coarse in texture.

__ 10. An Austrian Pine will tolerate salt, wind, and drought.

__ 11. A Mugo Pine is drought resistant.

Broad-leaved evergreens

___ 1. A Glossy Abelia may be pruned or sheared into a dense hedge.

___ 2. A Krume Azelia grows well in full sun.

___ 3. The English or Common Boxwood grows well in part shade to shade.

____4. The Silverberry or Thorny Elaeagnus has fragrant flowers.

____5. The Evergreen or Japanese Euonymus has no serious pest problems.

____6. The American Holly has a hardiness zone of 6.

____7. The Purple-leaved Honeysuckle has a slow growth rate.

____8. The Southern Magnolia needs minimal space to grow.

____9. The Nandina is a tough, maintenance-free plant.

___10. The Live Oak is a rounded shrub.

___11. A Frasers Photinia has inconspicuous flowers.

___12. The Ajuga is a fine-textured ground cover.

___13. Carolina yellow Jessamine is a good plant to grow in public places around children because of its beauty.

NAME ______________________________ SCORE _______

**OBJECTIVE 12** **Recommend evergreens for various landscape situations.**

**DIRECTIONS** Read the following situations and answer the questions using information supplied in Supplement 3. You should also review information for Objective 10, landscape uses for evergreens. Write your answers in the blanks.

1. Jan Jones lives in Zone 7 would like to plant some shrubs on the north side of her house which receive sun to partial shade. She would like the shrubs to be broad-leaved evergreens with conspicuous flowers. What would you recommend? What questions might you ask to narrow down the choices?

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

2. Kelly Blossom is interested in planting a narrow-leaved or broad-leaved evergreen in his front yard. He would like a large, upright, specimen tree that can grow in sun to shade and is adaptable to Zones 6 or 7. What would you recommend?

________________________________________

________________________________________

________________________________________

________________________________________

3. Terry Gardner owns a brick home in Zone 8. He would like to plant Nandinas in front of his home, up against the brick wall. The area gets quite hot in the summer. Would you agree or disagree with his choice? Explain.

________________________________________

________________________________________

________________________________________

________________________________________

4. The Smiths own a convenience store that has a sloped planter area in front that needs landscaping. They want to use ground cover that is attractive to customers, can help control erosion, are is relatively low-maintenance. They do not like junipers and would prefer a broad-leaved evergreen. What would you recommend? What other information might you need to know about the site?

________________________________________

________________________________________

________________________________________

________________________________________

5. Mr. and Mrs. Taylor are retired and enjoy maintaining a showy garden. They are interested in purchasing some small (3- to 4-feet high), colorful flowering shrubs for a shady area near their home. What might you recommend, and what suggestions on soil, pest problems, and maintenance would you give them?

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

## ASSIGNMENT ANSWERS

## INTRODUCTION TO EVERGREENS

## XVII

**ASSIGNMENT SHEET 1**

Narrow-leaved

1. T
2. F
3. F
4. T
5. T
6. T
7. T
8. F
9. F
10. T
11. F

Broad-leaved

1. T
2. F
3. F
4. T
5. F
6. F
7. F
8. F
9. T
10. F
11. F
12. F
13. F

**ASSIGNMENT SHEET 2**

1. Jerry Jones could select a Silverberry or Thorny Elaeagnus, an Evergreen or Japanese Euonymus, or a Frasers Photinia. Other questions to ask might include: How much garden space do you have? What type of soil do you have? What kind of texture would you like? What kind of shape are you interested in? Are you concerned about garden pests?

2. Kelly Blossom could select an Atlas Cedar, Arizona Cypress, American Holly, Southern Magnolia, or Live Oak.

3. Disagree. Nandinas do not grow well in hot areas caused by structures or concrete.

4. Purple-leaved honeysuckle. You would also want to know hardiness zone, exposure, and condition of the soil.

5. Azelia Kurume. The Taylors have time to care for these high maintenance plants. Soil should be well-drained, fertile, moist, acid loam or sandy loam with high organic content. The Taylors should be warned about lace bugs, spider mites, and mushroom rot. They should be warned that too much sun or wind can kill the plants.

**WRITTEN TEST**

# INTRODUCTION TO EVERGREENS

# XVII

NAME ______________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with evergreens to their correct definitions.** Write the correct letters in the blanks.

___ 1. A cultivated variety of plant that will retain its distinguishing features when reproduced

___ 2. Not actively growing, but capable of resuming growth when environmental conditions become favorable

___ 3. Plant that keeps its foliage year round

___ 4. Latin identification of plant materials divided into genus and species

___ 5. Bundle or sheath that holds pine needles

___ 6. Evergreen with wide leaves

___ 7. A delicate, scaly-bracted, usually drooping, spike of flowers

___ 8. Plant that bears cones

___ 9. The ability of a plant to survive in cold temperatures

___ 10. Any plant displayed to its best advantage either alone or in multiple plantings

___ 11. A cone with a fleshy seed coat instead of scales

a. Conifer

b. Dormant

c. Species

d. Cultivar

e. Catkin

f. Needles

g. Bract

h. Broad-leaved evergreen

i. Evergreens

j. Pistol

k. Fascicle

l. Cattail

m. Stem

n. Hardiness

o. Strength

p. Botanical name

q. Bedding plant

___12. Evergreen with narrow or needle-like leaves

___13. A modified leaf at the base of a flower or belonging to a cluster of flowers

r. Aril

s. Specimen plant

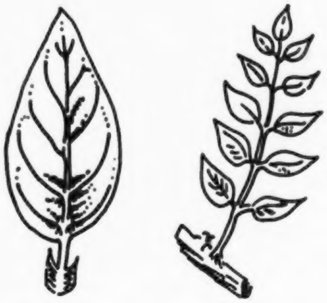
t. Narrow-leaved evergreen

**OBJECTIVE 2** **List five features used to identify evergreens.**

1. ________________________________________
2. ________________________________________
3. ________________________________________
4. ________________________________________
5. ________________________________________

**OBJECTIVE 3** **Describe parts of a leaf of a broad-leaved evergreen. Write the name of the part and a short description in the blanks.**

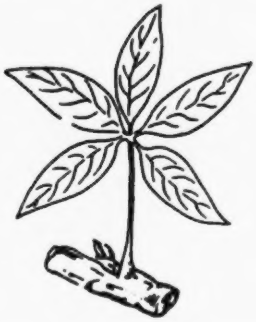
FIGURE 1



1.________________________________________
2.________________________________________
3.________________________________________
4.________________________________________
5.________________________________________

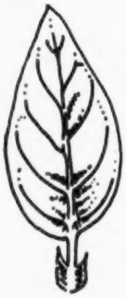
**OBJECTIVE 4** **Describe types of leaves associated with broad-leaved evergreens.**

FIGURE 2



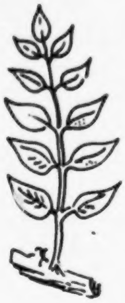
1. ______________________

FIGURE 3



2. ______________________

FIGURE 4

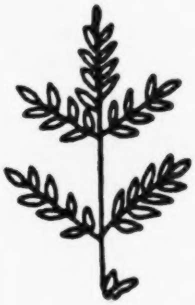


3. ______________________________

______________________________

______________________________

FIGURE 5



4. ______________________________

______________________________

______________________________

**OBJECTIVE 5**

**LABEL types of leaves associated with narrow-leaved evergreens.**

FIGURE 6

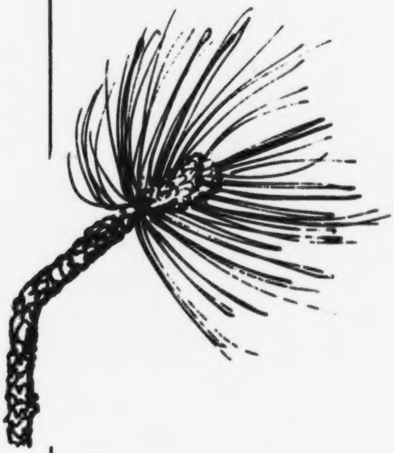
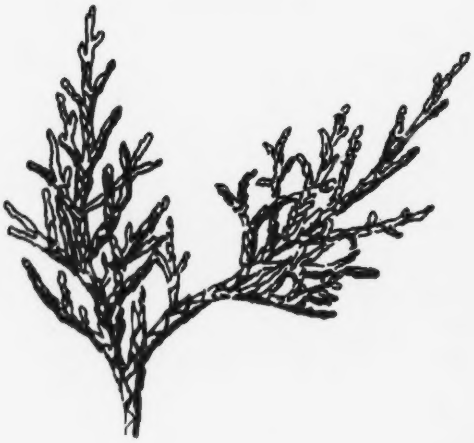


FIGURE 7

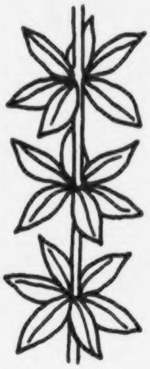


1. ____________________

2. ____________________

**OBJECTIVE 6** **Describe common evergreen leaf arrangements. Write the correct answers in the blanks below the illustrations.**

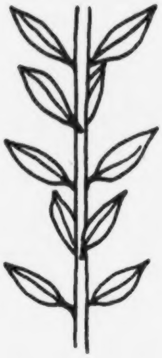
FIGURE 8



1. ______________________________________________

______________________________________________

FIGURE 9

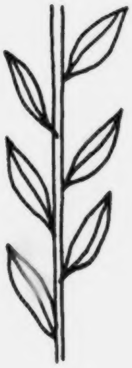


2. ______________________________________________

______________________________________________

1112

FIGURE 10



1. ______________________________

______________________________

**OBJECTIVE 7**

**Describe types of flowers on a broad-leaved evergreen.** Write the correct answers in the blanks.

______________________________

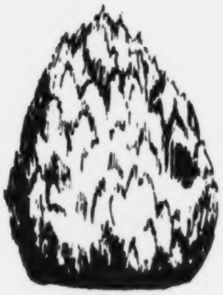
______________________________

**OBJECTIVE 8**

**Label evergreen plant forms.** Write the description of the correct form in the blanks.

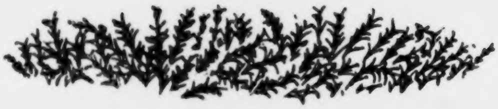
**Narrow-leaved:**

FIGURE 11



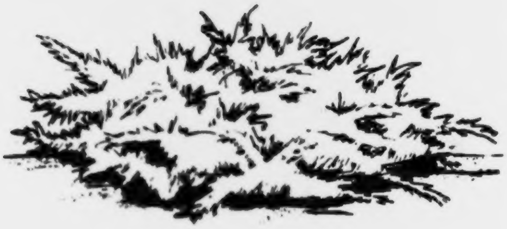
1. ______________________________

FIGURE 12



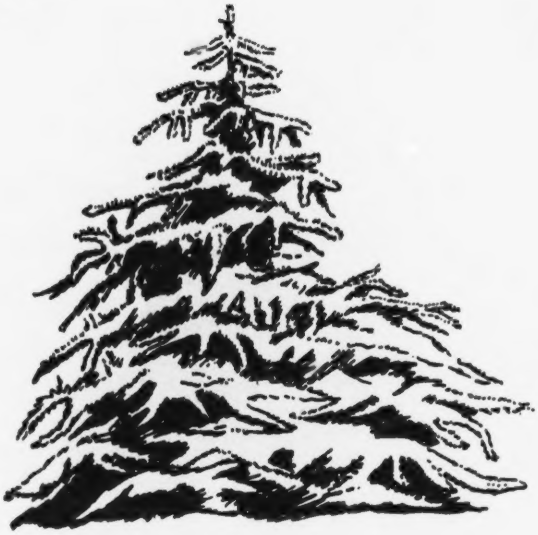
2. ______________________________________________

FIGURE 13



3. ______________________________________________

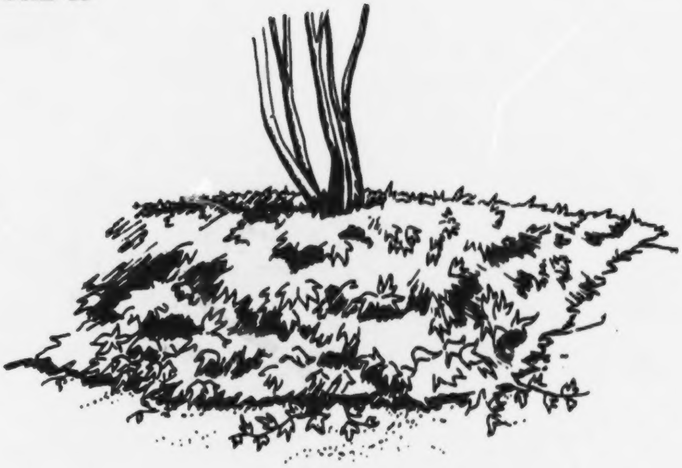
FIGURE 14



3. ________________________________________

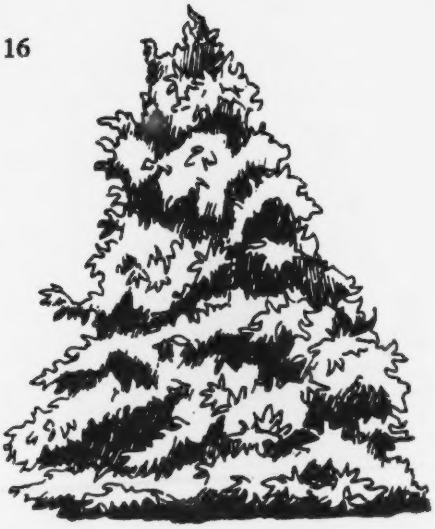
**Broad-leaved:**

FIGURE 15



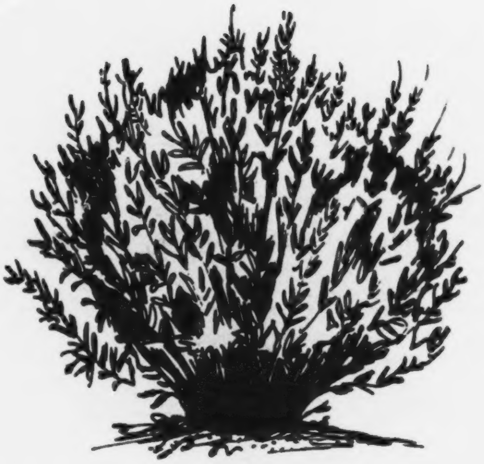
1. ____________________

FIGURE 16



2. ____________________

FIGURE 17



3. ______________________________

**OBJECTIVE 9**

**Select from a list qualities to consider when selecting an evergreen for a landscape.** Write an "X" in the blanks in front of the correct answers.

___ 1. Color

___ 2. Disease and insect problems

___ 3. Budding

___ 4. Exposure

___ 5. Size

___ 6. Soil requirements

___ 7. Personality

___ 8. Climate (Hardiness)

___ 9. Leaf shape

___ 10. Bark

**OBJECTIVE 10** **List landscape uses for evergreens.** List three uses for each form.

Evergreen ground cover (low, creeping)

______________________________

______________________________

______________________________

Spreading and small upright evergreens

______________________________

______________________________

______________________________

Evergreen trees

______________________________

______________________________

______________________________

**NOTICE** The following assignment sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 11** **Select true statements regarding narrow-leaved and broad-leaved evergreens.** SCORE ________

**OBJECTIVE 12** **Recommend evergreens for various landscape situations.** SCORE ________

## WRITTEN TEST ANSWERS

## INTRODUCTION TO EVERGREENS

## XVII

**OBJECTIVE 1**

1. d
2. b
3. i
4. p
5. k
6. h
7. e
8. a
9. n
10. s
11. r
12. t
13. g

**OBJECTIVE 2**

Answers should include any five of the following

- Flower type
- Fruit type
- Leaf shape and arrangement
- Stem type
- Bark
- Plant shape (form)

**OBJECTIVE 3**

1. Stipules—Secondary growth at the base of a petiole
2. Petiole—Stalk at the base of a leaf (leaf stem)
3. Blade—Expanded, flattened portion of a leaf, attached to the petiole
4. Rachis—Central stem of compound leaves
5. Leaflet—A single division of a compound leaf

**OBJECTIVE 4**

1. Palmately compound—Leaf divided into sections so that it appears like fingers on a hand
2. Simple—Leaf that is one solid piece; undivided
3. Pinnately compound—Leaf with leaflets arranged opposite each other along the rachis
4. Bi-pinnately compound (twice pinnate)—Leaf with leaflets that are also compound or divided

**OBJECTIVE 5**

1. Needle-like
2. Scale-like

**OBJECTIVE 6**

1. Whorled--An arrangement of three or more leaves radiating from a node
2. Opposite—Directly across from each other
3. Alternate—Found at different levels along a stem

**OBJECTIVE 7**

1. Conspicuous—Prominent, showy
2. Inconspicuous—Insignificant, not readily seen

**OBJECTIVE 8**

Narrow-leaved:

1. upright, semiconical, multiple trunk
2. creeping, ground cover
3. low, spreading
4. upright, conical, central leader

Broad-leaved:

1. creeping
2. upright, conical, central leader
3. upright, semiconical, multiple trunk

**OBJECTIVE 9**

1,2,4,5,6,8

**OBJECTIVE 10**

Answers should include three of the following for each form

Evergreen ground cover (low, creeping)

- Plant in front of buildings, along walks, and in rock gardens
- Plant in front of larger shrubs
- Provide good erosion protection; use on slopes or drape over walls
- Plant to add depth and variety to landscape

Spreading and small upright evergreens

- Provide screen for privacy and to hide unsightly views
- Can be pruned, used as hedges
- Can be used as backdrops for flower beds and low plantings
- Uprights (pyramidal and columnar) can be used as accent plants

Evergreen trees

- Can be used as tall screens, windbreaks
- Can be used to frame a view
- Should be used sparingly since they are often used as specimen or accent plants
- Should not be crowded; most need 12 to 25 feet to spread

**OBJECTIVE 11**

Refer to answers to Assignment Sheet 1.

**OBJECTIVE 12**

Refer to answers to Assignment Sheet 2.

**OBJECTIVE SHEET**

# INTRODUCTION TO TRANSPLANTING

# XVIII

**INTRODUCTION**

Transplanting is a common operation in nursery and landscaping businesses. In nurseries, seedlings must be moved from a flat into a larger container or into the ground. Larger outdoor plants such as trees and shrubs purchased from a nursery must eventually be put into the ground. Knowing how and when to plant is an important part of the process. Landscape workers must know how to properly transplant trees and shrubs to give them the best chance of survival. If the steps are not done correctly, plants may take longer to adjust and become established in new surroundings or, worse yet, die in the process. A correctly transplanted tree, shrub, or seedling will have a better chance of a healthier and longer life.

**UNIT OBJECTIVE**

After completing this unit, the student should be able to name types of transplanting and types of mulches, and demonstrate several transplanting procedures. The student will demonstrate these competencies by completing assignment sheets, job sheets, and the written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with transplanting to their correct definitions.
2. Name types of transplanted stock.
3. Name factors to consider when transplanting trees and shrubs.
4. Select from a list examples of organic and inorganic mulches.
5. Select from a list reasons for mulching.
6. Select from a list true statements about comparisons between ball-and- burlap method and bare-root method.
7. Describe advantages and disadvantages of transplanting container stock.
8. Determine ball size. (Assignment Sheet 1)

9. Demonstrate the ability to
    a. Transplant seedlings from a flat into pots. (Job Sheet 1)
    b. Transplant rooted cuttings into pots. (Job Sheet 2)
    c. Ball and burlap a tree or shrub. (Job Sheet 3)
    d. Transplant balled-and-burlapped stock. (Job Sheet 4)
    e. Transplant a bare-root tree or shrub. (Job Sheet 5)
    f. Transplant container stock. (Job Sheet 6)
    g. Heel-in bare-root stock. (Job Sheet 7)

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Gather books, catalogs, charts, and posters that deal with transplanting.
- Contact your local county or cooperative extension horticulturist for recent literature and fact sheets related to the topic.
- Arrange for guest speakers from local nurseries or garden centers.

  **NOTE:** Supply guest speaker with objectives and other appropriate sections of the unit and information to be covered.

- Decide how to administer pretest.

## DELIVERY

Discuss the unit and specific objectives. Emphasize how the specific objectives will lead to meeting the unit objective and how reaching the unit objective is vital in horticulture careers. Relate the objectives to your introduction and to previous class material.

**Objective 1**

- Use information sheet to discuss terms associated with transplanting.
- Show students examples of those terms.

**Objective 2**

- Use information sheet to name types of transplanted stock.

- Show students examples of these types of stock.
- Describe which plants are best suited for each type of transplanting. For example, most bare-root trees and shrubs are deciduous and most balled-and-burlapped trees are evergreens or large trees.

**Objective 3**

- Use information sheet to discuss factors to consider when transplanting.
- Discuss how rainfall, hardiness zones, soil, and other factors determine what kind of greenery should be planted and when.

**Objectives 4 and 5**

- Use information sheet to name types of mulches and reasons for mulching.
- Show students examples of the different types of mulches and describe where they would be used.
- Use handout to discuss mulch materials and their characteristics.
- Discuss pros and cons of mulching; show students examples of plants or trees that have been mulched compared to plants that have not been mulched.
- Have students complete handout questions.

**Objective 6**

- Use information sheet to discuss comparisons between ball-and-burlap method and bare-root method.
- Show students examples of plants ready for ball-and-burlap transplanting and plants ready for bare-root transplanting and point out the comparisons.

**Objective 7**

- Use information sheet to go over advantages and disadvantages of transplanting container stock.
- Show students examples of container stock, and use the examples to point out advantages and disadvantages.

**APPLICATION**

**Objective 8**

- Go through steps on determining ball size, and have students practice those steps using a live tree or shrub.
- Have students complete Assignment Sheet 1.

**Objective 9**

- Visit local nurseries or garden centers to see different types of transplanted stock and heeled-in stock.
- Gather tools and equipment needed for procedures outlined on job sheets.
- Demonstrate procedures outlined in job sheets, and allow students to practice those procedures.
- Have students complete Job Sheets 1 through 7.

**EVALUATION**

**Practical Test**

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

**Written test**

- Explain to students that they will be asked to demonstrate on the written test those actions listed in the specific objectives.
- Give written test.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest as necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

**SUGGESTED RESOURCES**

**Audiovisual Materials**

- *Planting Techniques Part I: Trees and Shrubs.* VHS video. Discusses how successful growth and development of newly installed landscape plants depends on proper plant selection, correct site preparation, use of appropriate planting techniques, and proper follow-up care. Topics include plant selection, site selection, containerized woody plants, planting a container-grown pear tree, staking trees, bare root trees and shrubs, and balled and burlapped plants.

  NOTE: Available from Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407;1-800-235-4146.

**Publications**

- Bienz, D.R. *The Why and How of Home Horticulture*. San Francisco: W.H. Freeman and Company, 1980.
- Carrick, James. *Planting, Growing, Caring*. New Brunswick, New Jersey: Rutgers—The State University. n.d.
- Denisen, Ervin L., *Principles of Horticulture*. New York: Macmillan Publishing Co., Inc., 1958.
- Harris, Richard W., *Arboriculture, Care of Trees, Shrubs, and Vines in the Landscape*. New Jersey: Prentice-Hall, Inc., 1983.
- Kays, W.R. *Mulching Garden Soils*. Stillwater, Oklahoma: Oklahoma State University Cooperative Extension Services facts sheet No. 6005. n.d.
- Mitchell, Paul. *Planting Shade Trees and Shrubs*. Stillwater, Oklahoma: Oklahoma State University Cooperative Extension Services facts sheet No. 6414. n.d.
- Murphy, Richard C., and Meyer, William E. *The Care and Feeding of Trees*, 2nd ed. New York: Crown Publishers, Inc., 1969.
- *Horticulture Occupations*. Catalogs SIA, 31B. College Station, Texas: Texas A&M University, 1985.

OBJECTIVE 1

**Match terms associated with transplanting to their correct definitions.**

- **Bare-root**—Tree or shrub for transplanting that has little or no soil around the roots
- **Ball and burlap**—Tree or shrub with an undisturbed mass or soil remaining on the roots; wrapped in sacking and/or a wire basket
- **Container stock**—Landscape plant materials grown in some type of container
- **Caliper**—Measure of stem or trunk diameter or thickness 12 inches above soil line
- **Dibble**—Tool used to make a small hole in soil for transplanting seedling
- **Sunscald**—Injury or death of bark due to intense light
- **Guying**—Method of bracing a tree using wire running at a 45 degree angle from the tree trunk to short stakes in the ground
- **Heeling-in**—Placing young plants temporarily in a trench to prevent their roots from drying out.
- **Mulching**—Covering the topsoil to reduce evaporation, cultivation, and erosion
- **Rootbound**—Tightly packed, intertwined roots
- **Staking**— Method of bracing a tree using wire running horizontally from the tree trunk to long stakes in the ground

  **NOTE: Staking is unnecessary for shrubs, many conifers, and trees with limbs growing close to the ground**

- **Starter fertilizer**—A low-strength fertilizer used to help establish a plant's roots

  NOTE: You can make a starter solution by adding 2 to 3 tablespoons of complete fertilizer such as 5-1-5, 10-10-1, or 10-20-10 to a gallon of water; mix well.

**OBJECTIVE 2**

**Name types of transplanted stock.**

- Seedlings
- Rooted cuttings
- Bare-root stock

  **NOTE:** These plants are usually deciduous.
- Balled-and-burlapped stock

  **NOTE:** These plants are often evergreens or large trees.
- Container stock

**OBJECTIVE 3**

**Name factors to consider when transplanting trees and shrubs.**

- Select the proper tree or shrub for the location

  **NOTE:** Consider such factors as climate, rainfall, exposure, soil quality, and ultimate size of tree or shrub.
- Make sure soil is well-drained
- The best time to transplant bare-root stock is in early fall (usually between mid-February and mid-April)
- Deciduous trees and shrubs should be planted before new growth appears
- Ball-and-burlapped and container stock can be transplanted any time, but is usually done before spring

**OBJECTIVE 4**

**Select from a list examples of organic and inorganic mulches.** (Supplement 1)

**NOTE**: Mulching materials should not pack down and should be effective for at least one season.

- Organic mulches—These materials will decompose

  EXAMPLES: Shredded bark, sawdust, peat moss, hay, leaves, wood chips, ground corn cobs, cotton seed hulls, nut shells
- Inorganic mulches—These materials will not decompose

EXAMPLES: Weed barrier, crushed stone, black plastic, aluminum foil

**OBJECTIVE 5**

**Select from a list reasons for mulching.**

- Prevent growth of weeds
- Reduce moisture evaporation
- Regulate soil temperature
- Prevent erosion
- Provide more attractive landscape

**OBJECTIVE 6**

**Select from a list true statements about comparisons between ball-and-burlap (B-and-B) method and bare-root method.**

- Ball and burlap offers roots more protection than bare-root plants
- Ball-and-burlap method can be done on extremely large trees, whereas bare-root method can be done only on small plants
- Ball-and-burlap method takes less time than bare-root method; however, digging process is more time consuming with ball-and-burlap method
- Materials such as nails, twine, wire baskets, and container for soil ball are needed for ball-and-burlap method

**OBJECTIVE 7**

**Describe advantages and disadvantages of transplanting container stock.**

Advantages:

- Container stock can be transplanted at any time so stock will be in bloom when desired
- Color of bloom on container stock can be seen at time of transplanting, ensuring correct selection of color
- Container stock is less expensive to produce than ball-and-burlap stock
- Transporting container stock is easier than transporting ball and burlap or bare-root stock

- Container stock does not require immediate transplanting
- Roots remain intact on container stock

Disadvantages:

- Transplanting container stock may be more difficult because can or container must be removed from stock
- Container stock can become rootbound if left in container too long

## CHARACTERISTICS OF SOME MULCH MATERIALS[a]

| Materials | Does the Mulch Crust, Pack or Seal | Will the Mulch Control Grass and Weed | Will the Mulch Remain Effective for a Season | Blaze (fire) Possibility | Available Nutrients Present | Remarks |
|---|---|---|---|---|---|---|
| Peat Moss | 2 | 2 | 2 | 2 | 4 | May be blown or moved by wind or rain |
| Sawdust | 2 | 2 | 2 | 2 | 5 | *10-12 lbs./bushel |
| Bagasse | 2 | 2 | 2 | 2 | 5 | *May be blown by wind |
| Cotton seed hulls | 4 | 2 | 2 | 2 | 2 | *Usually remains where placed |
| Straw | 1 | 2 | 2 | 5 | 3 | *Presprout seed by wetting bales |
| Leaves[b] | 3 | 3 | 2 | 3 | 3 | *May be blown by wind |
| Cotton burrs | 2 | 2 | 2 | 2 | 2 | *Don't use burrs from chemically defoliated plants |
| Lawn clippings | 5 | 3 | 4 | 5 | 2 | Compost - don't use fresh as a mulch |
| Hay - prairie | 1 | 3 | 2 | 4 | 3 | *Usually better if chopped |
| Hay - legume | 2 | 3 | 2 | 3 | 2 | May become very hot during early decay |
| Compost | 1 | 2 | 2 | 1 | 1 | Also used as a row cover in seed planting |
| Wood chips | 1 | 3 | 1 | 2 | 5 | Excellent permanent mulch |
| Bark[b] | 1 | 2 | 1 | 2 | 5 | Excellent permanent mulch |
| Wood shavings[b] | 1 | 2 | 1 | 5 | 5 | * |
| Leaf mold | 1 | 2 | 2 | 2 | 3 | * |
| Gravel pebbles | 3 | 4 | 1 | 1 | 5 | Frequently used over polyethylene |
| Aluminum foil | 5 | 1 | 1 | 1 | 5 | May aid in insect control |
| Black polyethylene | 5 | 1 | 1 | 2 | 5 | Will destroy perennial grasses and weeds |

---

[a] 1 = excellent, 5 = poor

[b] Black walnut sawdust, bark and leaves are very toxic to some kinds of plants

* Add 1 pound actual nitrogen per 50 pounds of dry organic matter to provide for decomposition

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**ACTIVITY SHEET 1**

## INTRODUCTION TO TRANSPLANTING

## XVIII

**DIRECTIONS**

Use Student Supplement 1 on "Characteristics of Some Mulch Materials" to answer the following questions. Write your answers in the blanks provided.

1. Name two types of compost that are excellent permanent mulches *AND* rate highest on the chart for not crusting, packing, or sealing.

   ____________________

   ____________________

2. Name two of the mulches with the highest fire hazard.

   ____________________

   ____________________

3. Name the mulch with the highest available nutrients present.

   ____________________

4. Name the two mulches that provide the most effective grass and weed control.

   ____________________

   ____________________

5. Name the mulch that is least effective in controlling grass and weeds.

   ____________________

6. Name the mulch that rates poorest in remaining effective for a season.

   ____________________

7. Name the mulch that is frequently used over black polyethylene.

   ____________________

8. Name the mulch that may become very hot during early decay.

   ____________________

## INTRODUCTION TO TRANSPLANTING

**ACTIVITY SHEET 1**

1. Answer should include two of the following.

   Wood chips

   Bark

   Wood shavings

2. Answers should include two of the following.

   Straw

   Lawn clippings

   Wood shavings

3. Compost

4. Answers should include the following.

   Aluminum foil

   Black polyethylene

5. Gravel pebbles

6. Lawn clippings

7. Gravel pebbles

8. Hay—legume

**ASSIGNMENT SHEET 1**

# INTRODUCTION TO TRANSPLANTING

# XVIII

**OBJECTIVE 8**

**Determine ball size.**

NAME ______________________________ SCORE _______

**INTRODUCTION**

Determine the ball size of plant to be transplanted by following these steps.

1. Measure stem caliper 12 inches above soil line
2. Multiply stem caliper by 10 inches and 12 inches for range of soil-ball diameter

   EXAMPLE: For a tree with a 4-inch caliper

   4 x 10 = 40
   4 x 12 = 48
   Soil ball range = 40 to 48 inches

3. Depth of ball is 1/2 to 2/3 diameter of soil ball

   EXAMPLE: 48-inch diameter
   48 x 1/2 = 24
   48 x 2/3 = 32
   Range for depth of ball = 24 to 32 inches deep

**DIRECTIONS**

Using the following information, determine the soil-ball range or depth of ball as requested. Write the answers in the spaces provided. Round off answers to the nearest whole number.

1. A pine tree has a 3-inch caliper when measured 12 inches above the soil line. Determine the soil-ball range.

   ANSWER:_______ to _______ inches

2. A maple tree has a 7-inch caliper when measured 12 inches above the soil line. Determine the soil-ball range.

   ANSWER:_______ to _______ inches

3. An oak tree has a soil ball diameter of 38 inches. Determine the depth of the ball.

   ANSWER: _______ to _______ inches deep

4. A willow tree has a soil ball diameter of 16 inches. Determine the depth of the ball.

ANSWER:_______ to _______ inches deep

| ASSIGNMENT ANSWERS | INTRODUCTION TO TRANSPLANTING | XVIII |
|---|---|---|

**ASSIGNMENT SHEET 1**

1. 30 to 36 inches
2. 70 to 84 inches
3. 19 to 25 inches deep
4. 8 to 11 inches deep

**JOB SHEET 1**

# INTRODUCTION TO TRANSPLANTING

# XVIII

**OBJECTIVE 9a**

**Transplant seedlings from a flat into pots.**

**INTRODUCTION**

Transplanting seedlings is a common duty in nursery work. It is important to remember that seedlings are fragile and should not be handled by the stem which could be crushed. As with all transplanting operations, the job should be done as quickly as possible to keep roots from drying out.

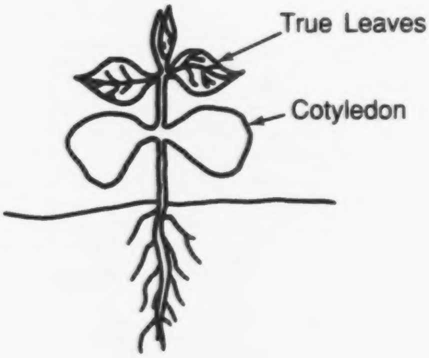
**TOOLS AND EQUIPMENT**

- Flat containing plants
- Pots for plants
- Medium (soil)
- Knife or some other tool for loosening rooting medium
- Dibble or pencil
- Water
- Plant labels
- Premixed fertilizer

**PROCEDURE**

1. Make sure plants have two true leaves at time of transplanting. (Figure 1)

FIGURE 1



2. Fill pots with soil.

3. Water soil thoroughly.

   **NOTE:** Watering after transplanting may cause plant to topple.

4. Using finger, dibble, or pencil, make holes larger than seedling root system.

5. Loosen soil around seedling in flat with knife; be careful not to injure plant.

   **NOTE:** Slightly dry soil makes removal easier.

6. Remove seedlings one at a time; carefully hold seedling by a leaf, NOT the stem.

7. Place entire root system within the hole.

8. Firm soil back around stem of the plant.

9. Water lightly, if needed.

10. Label tag with important information and place in pot:

    a. Crop name and variety

    b. Date transplanted

11. Add fertilizer; this can be made by mixing one tablespoon water-soluble, high phosphate fertilizer in one gallon of water.

12. Have instructor evaluate your work.

13. Clean work area and put away tools and equipment.

**JOB SHEET 2**

# INTRODUCTION TO TRANSPLANTING

# XVIII

**OBJECTIVE 9b**

**Transplant rooted cuttings into pots.**

**TOOLS AND EQUIPMENT**

- Cuttings
- Pots for transplanting, if needed
- Medium (soil), if needed
- Water
- Digging tool, such as dibble or pencil

**PROCEDURE**

1. Prepare pot or soil by digging a hole slightly larger than roots.
2. Remove cutting from rooting medium or small pot leaving some soil in place around roots.
3. Place cutting in prepared soil making sure to separate roots.
4. Firm soil in place around cutting.
5. Water thoroughly allowing soil to settle.
6. Add additional soil as needed.
7. Have instructor evaluate your work.
8. Clean work area and put away tools and equipment.

## INTRODUCTION TO TRANSPLANTING

**OBJECTIVE 9c**

**Ball and burlap a tree or shrub.**

**INTRODUCTION**

Trees and shrubs that are grown in a field are often removed using the ball-and-burlap method. The method is used on broad-leaved evergreens, which have roots that should stay in contact with moist soil. As with any type of transplanting, the job should be performed quickly to prevent the roots from drying out.

**TOOLS AND EQUIPMENT**

- Tree or shrub
- Nursery balling spade or shovel
- Burlap
- Nursery balling nails
- Caliper
- Twine

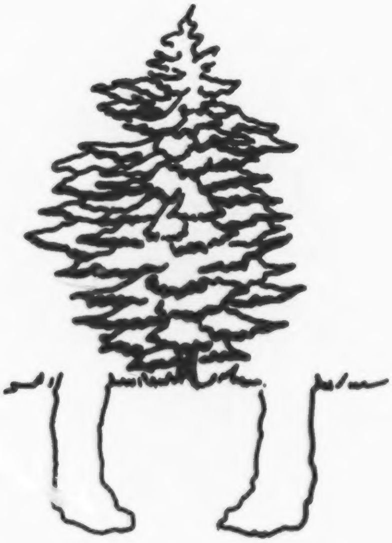
**PROCEDURE**

1. Measure stem caliper 12 inches above soil line.
2. Determine ball size needed. (See Assignment Sheet 1)
3. Trace ball diameter on soil surface to keep correct size.
4. Dig ball by forcing shovel straight down and working out.

   **NOTE:** Do not work shovel back and forth; ball may be damaged and not hold shape. Keep back of shovel toward the ball to prevent the shovel point from damaging the ball.

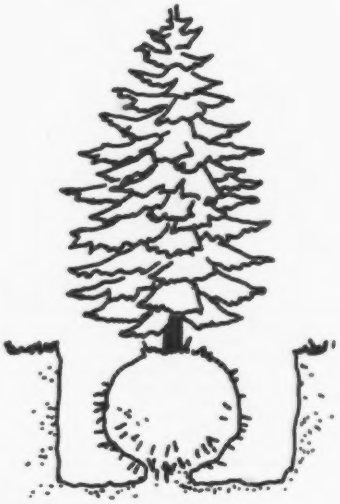
5. Increase hole size by trenching around the soil ball 2/3 to 1/2 as deep as the ball is wide; do this all the way around the tree. (Figure 2)

FIGURE 2



6. Round off the soil ball until only a small part of the underside remains attached. (Figure 3)

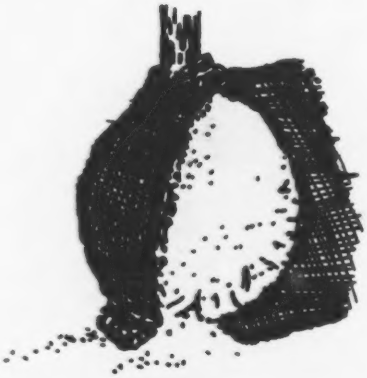
FIGURE 3



7. Carefully sever the attached area with shovel.

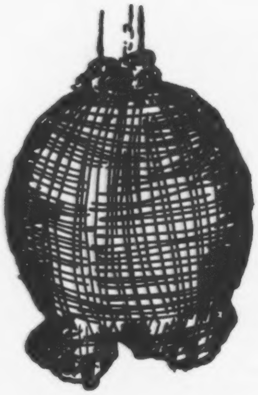
8. Fasten one corner of the sheet of burlap around the trunk with a nail. (Figure 4)

FIGURE 4



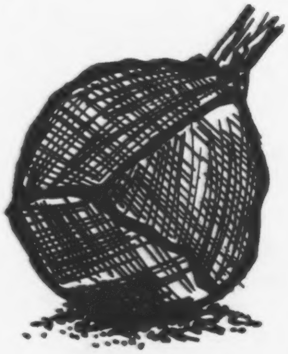
9. Pull burlap tightly around soil ball, taking up slack burlap with nails. (Figure 5)

FIGURE 5



10. Tip plant over gently and pin burlap over exposed soil. (Figure 6)

FIGURE 6



11. Have instructor evaluate your work.

13. Clean work area and put away tools and equipment.

**JOB SHEET 4**

## INTRODUCTION TO TRANSPLANTING

**XVIII**

**OBJECTIVE 9d**

**Transplant balled-and-burlapped stock.**

**INTRODUCTION**

Evergreens and large trees are often balled and burlapped before transplanting. Some landscape workers use a hydraulic tree spade when transplanting large specimens, but a shovel works well for smaller trees and shrubs. Remember to select your site carefully before transplanting. As with any type of transplanting, the job should be done quickly to keep the roots of the plant from drying out.

**TOOLS AND EQUIPMENT**

- Tree or shrub
- Soil amendments for backfill, if desired
- Nursery balling spade or shovel
- Staking and guying materials, if needed
- Starter fertilizer

**PROCEDURE**

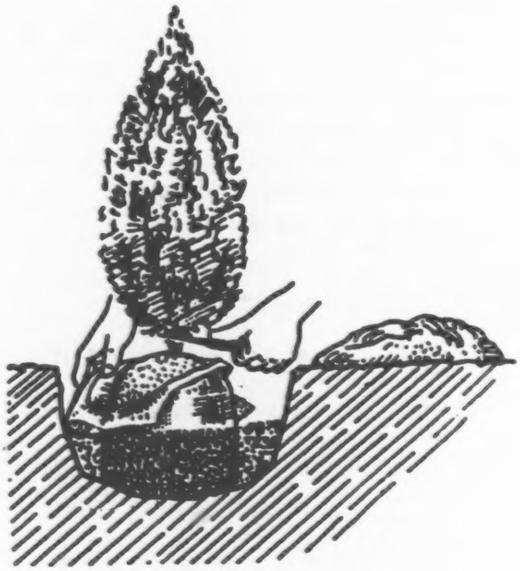
1. Water root ball thoroughly before transplanting.
2. Dig hole slightly deeper than the height of the root ball.

   NOTE: Plant should be at the same depth it was in field nursery.
3. Dig a hole about twice as wide as the diameter of the root ball.
4. Place balled-and-burlapped stock in hole, removing any wire or wire basket.
5. Place topsoil or soil mixture around root ball until hole is one-half to two-thirds full.

   NOTE: Soil amendments, such as composted cotton seed burrs, can be added to soil.
6. Firm soil and fill hole with water.

7. Remove ties or twine and roll burlap into the hole; the burlap will eventually rot. (Figure 7)

FIGURE 7



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8. Fill in hole completely with remaining soil mixture and water again.

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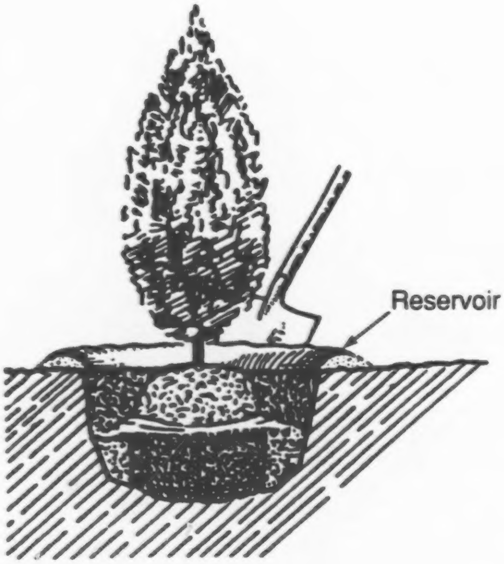
9. Form a reservoir with soil around tree to retain water. (Figure 8)

FIGURE 8



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**NOTE:** Steps 10 through 13 are not required in every planting job. Your instructor will select those required to complete this job.

10. Stake or guy for wind protection. (Figure 9 and 10)

**NOTE:** There are many methods of staking and guying trees. The combination of rubber hose, wire, and stakes is commonly used.

a. Run guy wire through section of rubber hose

b. Wrap hose loosely around trunk

c. Attach wire to stake

d. Pull wire tight and place in ground

FIGURE 9

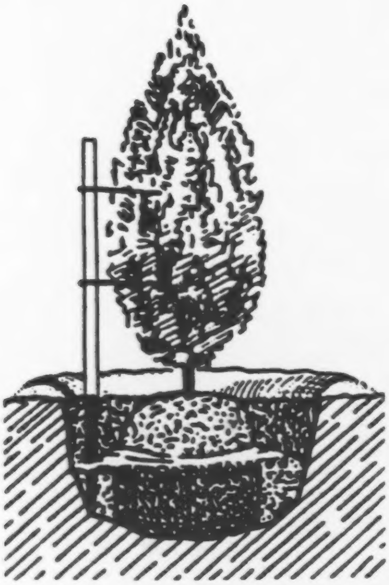
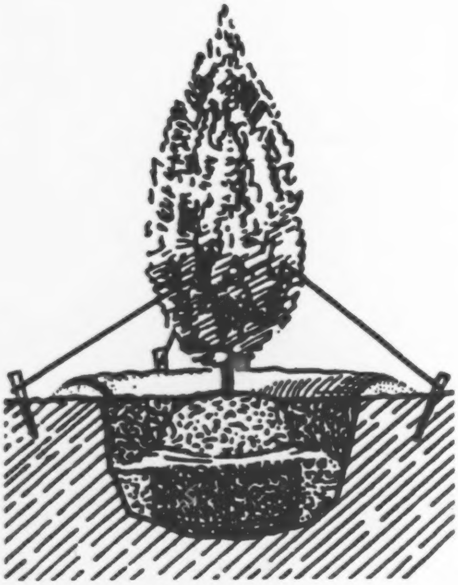


FIGURE 10



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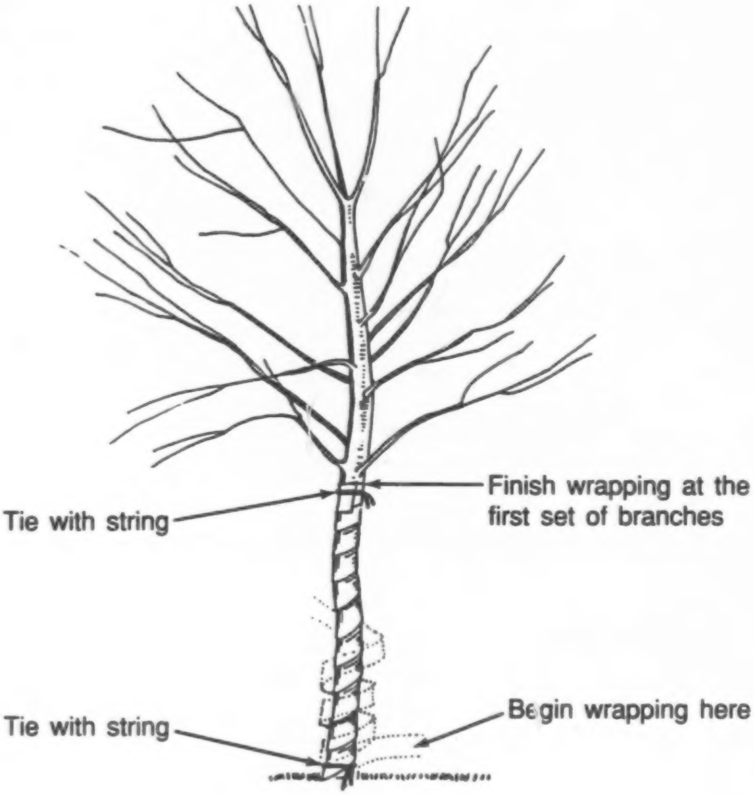
11. Wrap trunk with burlap, cheesecloth, or specially designed tree wrap material to prevent sunscald. (Figure 11)

FIGURE 11


Finish wrapping at the first set of branches
Tie with string
Tie with string
Begin wrapping here

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12. Fertilize lightly with starter fertilizer, following manufacturer's instructions.

    **NOTE:** Some authorities recommend against fertilizing evergreens.

13. Apply proper mulch, if desired.

14. Have instructor evaluate your work.

15. Clean work area and put away tools and equipment.

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**OBJECTIVE 9e**

**Transplant a Bare-root tree or shrub.**

**INTRODUCTION**

Bare-root trees and shrubs are often deciduous plants and should be planted before new growth appears. Remember to select your site carefully before transplanting. As with any type of transplanting, the job should be done quickly to keep the roots of the plant from drying out.

**TOOLS AND EQUIPMENT**

- Bare-root tree or shrub (usually packed in damp peat to keep roots from drying out)
- Shovel
- Water
- Staking or guying materials, if needed
- Pruning equipment such as hand shears or loppers
- Starter fertilizer

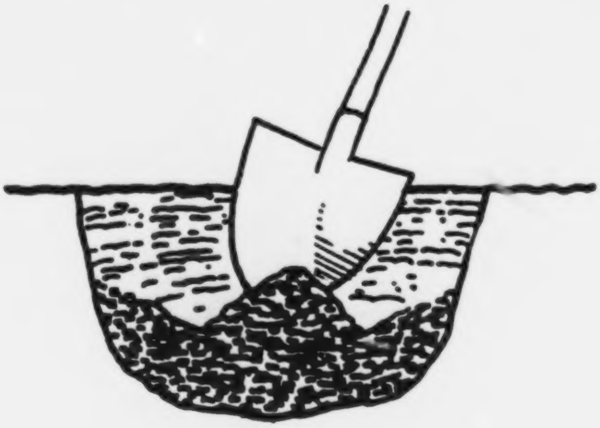
**PROCEDURE**

1. Dig a hole at about twice the spread of the roots of the tree or shrub.
2. Dig the hole deep enough so the plant will be at the same soil level as the original planting.

   **NOTE:** You can backfill to the proper depth with top soil or soil mixture. Soil amendments, such as composted cotton seed burrs, can be added to soil.

3. Make a mound or cone of the soil in the bottom of the hole. (Figure 12)

FIGURE 12



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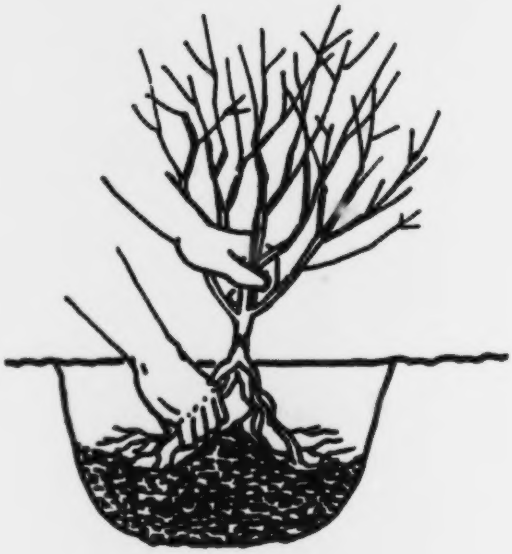
4. Remove packing from roots, and place tree or shrub in hole.

   **NOTE:** Do not remove packing material until hole is ready; if roots dry out, death may occur.

5. Spread roots out as much as possible over mound of soil, taking care not to curl roots around in the hole. (Figure 13)

**NOTE:** Roots not spread properly could eventually encircle and girdle the plant.

FIGURE 13



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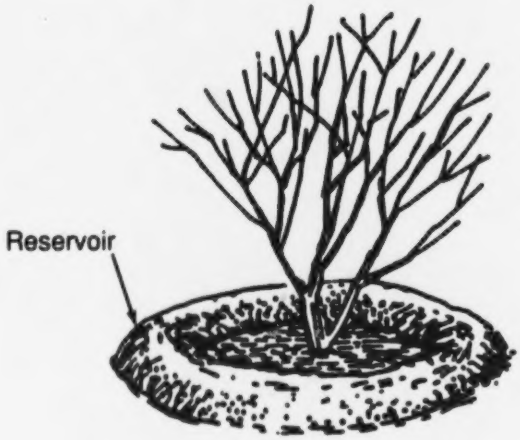
6. Fill in around roots with topsoil or soil mixture until hole is one-half to two-thirds full.
7. Firm soil around roots and fill hole with water.
8. Add remaining soil to fill hole; water thoroughly.

9. Form a reservoir for future watering. (Figure 14)

FIGURE 14



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**NOTE:** Steps 10 through 13 are note required in every planting jobl. Your instructor will select those required to complete this job.

10. Stake or guy tree or shrub. (Figures 15 and 16)
    a. Run guy wire through section of rubber hose
    b. Wrap hose loosely around trunk
    c. Attach wire to stake
    d. Pull wire tight and place in ground

NOTE: Eye bolts may be used instead of hose and wire; they can be removed the second year or may be left in.

FIGURE 15

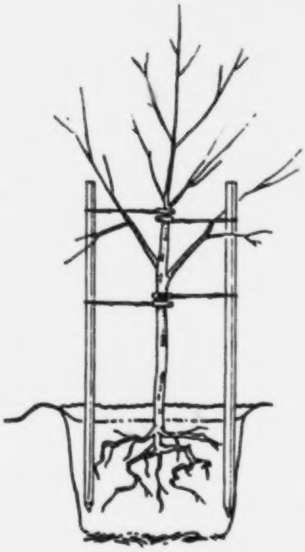
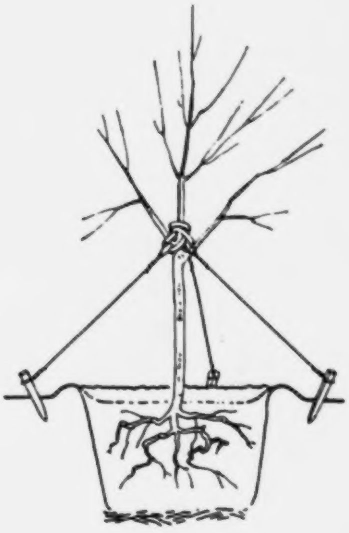


FIGURE 16



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11. Remove 1/4 to 1/3 of selected branches and damaged or dead wood; do NOT prune central leader.
12. Wrap trunk, if needed.
13. Fertilize plant with starter fertilizer according to manufacturer's instructions.
14. Have instructor evaluate your work.
15. Clean work area and put away tools and equipment.

**OBJECTIVE 9f** **Transplant container stock.**

**TOOLS AND EQUIPMENT**

- Container-grown tree or shrub
- Shovel
- Can cutter, if needed
- Water hose
- Knife or pruning shears
- Staking materials, if needed

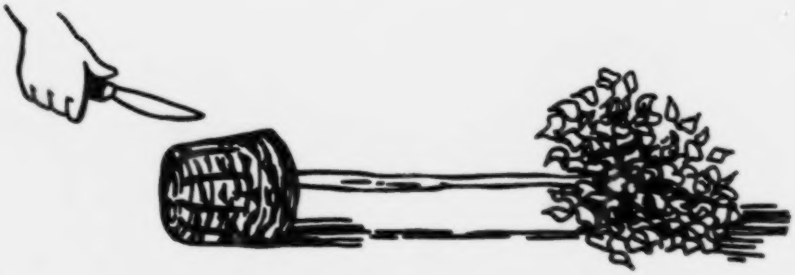
  EXAMPLES: Rubber hose sections, guy wires, stakes
- Starter fertilizer

**PROCEDURE**

1. Select healthy container stock.
2. Dig hole at the same level or slightly deeper than the container.
3. Dig hole about twice the diameter of the container.
4. Split can with can cutter, if can is metal.

   NOTE: Be careful not to break the root ball.
5. Remove plant, grasping at the base of the trunk.
6. If plant is rootbound make cuts with knife about 2 inches apart around root ball. (Figure 17)

FIGURE 17



7. Set the plant in the hole.

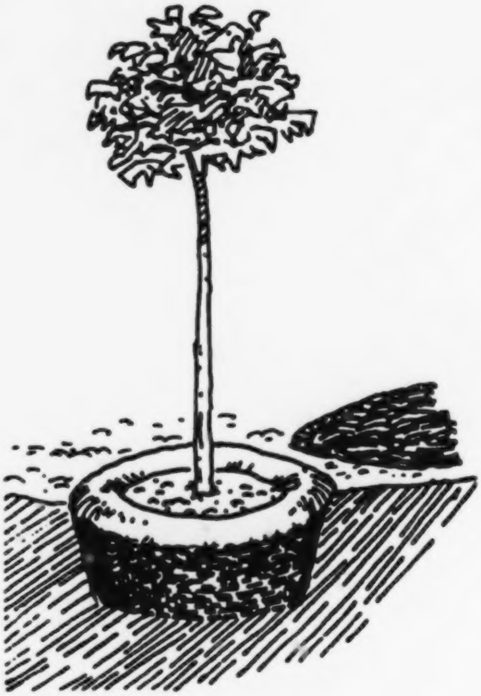
8. Fill in around roots with topsoil or soil mixture until hole is one-half to two-thirds full.

9. Firm soil around roots; water thoroughly.

10. Add remaining soil until hole is filled; water again.

11. Form reservoir for future watering. (Figure 18)

FIGURE 18



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**NOTE:** Steps 12 through 14 are not required in every planting job. Your instructor will select those required to complete this job.

12. Stake or guy for wind protection.

13. Wrap trunk, if needed.

14. Fertilize plant with starter fertilizer; follow manufacturer's instructions.

15. Have instructor evaluate your work.

16. Clean work area and put away tools and equipment.

## JOB SHEET 7 — INTRODUCTION TO TRANSPLANTING — XVIII

**OBJECTIVE 9g**

**Heel-in bare-root stock.**

**INTRODUCTION**

Bare-root deciduous plants that won't be planted within several months should be heeled-in to protect their roots. The roots of these trees and shrubs are easily injured if allowed to become dry.

**EQUIPMENT AND MATERIALS**

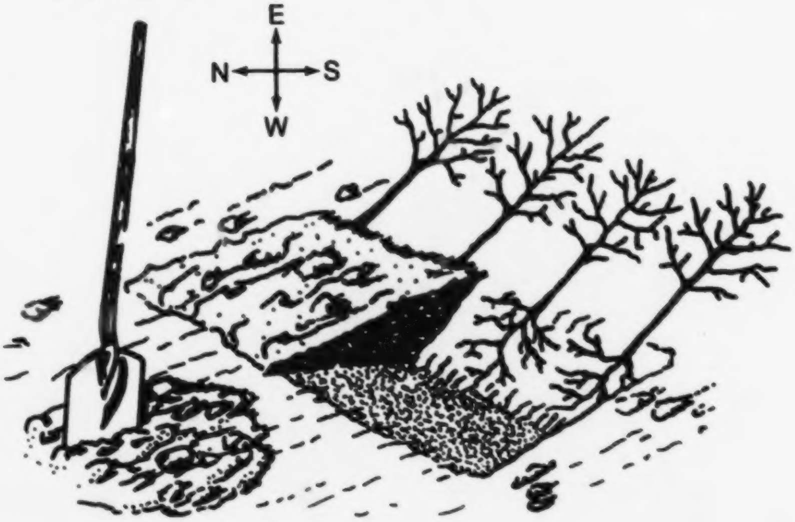
- Bare-root stock
- Shovel
- Water

**PROCEDURE**

1. Dig a V-shaped trench 12 to 18 inches deep; the angle of the trench should be such that trees are at a 45-degree angle to the ground.
2. Place the trees or shrubs closely together in the trench and position them so their tops point south. (Figure 19)

   NOTE: This position will help keep the tops of the plants from drying out and reduce the potential for sun-burned trunks.

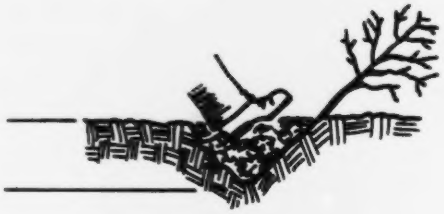
FIGURE 19



3. Use soil dug from the trench to fill in around roots and lower part of trees and shrub.

4. Press in soil by gently pushing down with the heel of a shoe. (Figure 20)

FIGURE 20



5. Water trees and shrubs; keep them moist.

6. Have instructor evaluate your work.

7. Clean work area and put away equipment and materials.

## PRACTICAL TEST 1

## INTRODUCTION TO TRANSPLANTING

## XVIII

**JOB SHEET 1**

**Transplant seedlings from a flat into pots.**

Student's name ________________________ Date __________

Evaluator's name ________________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Made sure plant has 2 true leaves. | ____ | ____ |
| 2. Filled pots with soil. | ____ | ____ |
| 3. Watered soil. | ____ | ____ |
| 4. Made hole for seedling. | ____ | ____ |
| 5. Loosened soil carefully around seedling. | ____ | ____ |
| 6. Removed seedling by leaf. | ____ | ____ |
| 7. Placed entire root system in hole. | ____ | ____ |
| 8. Firmed soil around stem. | ____ | ____ |
| 9. Watered lightly. | ____ | ____ |
| 10. Labeled plant. | ____ | ____ |
| 11. Added fertilizer. | ____ | ____ |
| 12. Practiced safety rules throughout procedure. | ____ | ____ |
| 13. Performed steps in a timely manner. | ____ | ____ |
| 14. Provided satisfactory responses to questions asked. | ____ | ____ |
| 15. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

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### PRODUCT EVALUATION

**Evaluator's note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Plant placement | 4 | 3 | 2 | 1 |
| Soil moisture | 4 | 3 | 2 | 1 |
| Plant label | 4 | 3 | 2 | 1 |

### EVALUATOR'S COMMENTS

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with not additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill-Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**JOB SHEET 2**

**Transplant rooted cuttings into pots.**

Student's name ____________________ Date ________

Evaluator's name ____________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Prepared sod by digging hole slightly larger than roots. | ____ | ____ |
| 2. Removed cutting, leaving some soil in place. | ____ | ____ |
| 3. Placed cutting in soil, making sure to separate roots. | ____ | ____ |
| 4. Firmed soil in place around cutting. | ____ | ____ |
| 5. Watered thoroughly. | ____ | ____ |
| 6. Added soil as needed. | ____ | ____ |
| 7. Practiced safety rules throughout procedure. | ____ | ____ |
| 8. Performed steps in a timely manner. | ____ | ____ |
| 9. Provided satisfactory responses to questions asked. | ____ | ____ |
| 10. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

### PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Placement of cutting in soil | 4 | 3 | 2 | 1 |
| Soil moisture | 4 | 3 | 2 | 1 |

### EVALUATOR'S COMMENTS

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**JOB SHEET 3**

**Ball and burlap a tree or shrub.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Measured stem caliper. | ____ | ____ |
| 2. Determined ball size. | ____ | ____ |
| 3. Traced ball diameter on soil surface. | ____ | ____ |
| 4. Dug ball properly. | ____ | ____ |
| 5. Increased hole size by digging around soil ball 2/3 to 1/2 as deep as the ball is wide. | ____ | ____ |
| 6. Rounded off ball until small part remained attached. | ____ | ____ |
| 7. Severed the attached area with shovel. | ____ | ____ |
| 8. Fastened one corner of burlap around trunk with nail. | ____ | ____ |
| 9. Pulled burlap tightly around ball, using nails. | ____ | ____ |
| 10. Tipped plant gently and pinned burlap over exposed soil. | ____ | ____ |
| 11. Practiced safety rules throughout procedure. | ____ | ____ |
| 12. Performed steps in a timely manner. | ____ | ____ |
| 13. Provided satisfactory responses to questions asked. | ____ | ____ |
| 14. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Size of ball | 4 | 3 | 2 | 1 |
| Placement of burlap | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

# PRACTICAL TEST 4

# INTRODUCTION TO TRANSPLANTING

# XVIII

**JOB SHEET 4**

**Transplant balled-and-burlapped stock.**

Student's name ________________________ Date __________

Evaluator's name ________________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Watered root ball. | ____ | ____ |
| 2. Dug hole at same height or slightly deeper than soil ball. | ____ | ____ |
| 3. Dug hole twice as wide as diameter of root ball. | ____ | ____ |
| 4. Placed stock in hole, removing wire. | ____ | ____ |
| 5. Placed soil in hole until 1/2 to 2/3 full. | ____ | ____ |
| 6. Firmed soil and added water. | ____ | ____ |
| 7. Removed ties and rolled burlap into hole. | ____ | ____ |
| 8. Filled hole with soil; watered again. | ____ | ____ |
| 9. Formed reservoir around tree. | ____ | ____ |
| **NOTE:** Steps 10-13 are performed at teacher's discretion. | | |
| 10. Staked or guyed tree. | ____ | ____ |
| 11. Wrapped trunk. | ____ | ____ |
| 12. Fertilized tree. | ____ | ____ |
| 13. Applied mulch, if desired. | ____ | ____ |
| 14. Practiced safety rules throughout | ____ | ____ |
| 15. Performed steps in a timely manner. | ____ | ____ |
| 16. Provided satisfactory responses to questions asked. | ____ | ____ |
| 17. Cleaned work area and put away tools. | ____ | ____ |

## EVALUATOR'S COMMENTS

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________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| **Plant depth** | 4 | 3 | 2 | 1 |
| **Soil moisture** | 4 | 3 | 2 | 1 |
| **Reservoir** | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

________________________________________

________________________________________

________________________________________

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

**4 - Skilled—Can perform job with no additional training**

**3 - Moderately skilled—Has performed job during training program; limited additional training may be required**

**2 - Limited skill—Has performed job during training program; additional training is required to develop skill**

**1 - Unskilled—Is familiar with process; but is unable to perform job**

**JOB SHEET 5**

**Transplant a bare-root tree or shrub.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Dug hole about twice the spread of roots. | | |
| 2. Dug hole so plant would be at same soil level as original planting. | | |
| 3. Made cone or mound in bottom of hole. | | |
| 4. Removed packing, placed plant in hole. | | |
| 5. Spread roots over mound of soil. | | |
| 6. Filled in with soil until hole is 1/2 to 2/3 full. | | |
| 7. Firmed soil around roots; watered. | | |
| 8. Added remaining soil; watered again. | | |
| 9. Formed reservoir for future watering. | | |
| NOTE: Steps 10-13 are performed at teacher's discretion. | | |
| 10. Staked or guyed tree or shrub. | | |
| 11. Removed 1/4 to 1/3 of selected branches. | | |
| 12. Wrapped trunk if needed. | | |
| 13. Fertilized plant according to manufacturer's instructions. | | |
| 14. Practiced safety rules throughout procedure. | | |
| 15. Performed steps in a timely manner. | | |

| The student: | YES | NO |
|---|---|---|
| 16. Provided satisfactory responses to questions asked. | _____ | _____ |
| 17. Cleaned work area and put away tools. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________

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**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Plant depth | 4 | 3 | 2 | 1 |
| Soil moisture | 4 | 3 | 2 | 1 |
| Reservoir | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

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## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**JOB SHEET 6**

**Transplant container stock.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected healthy container stock. | | |
| 2. Dug hole at same level or slightly deeper than container. | | |
| 3. Dug hole about twice the diameter of container. | | |
| 4. Split can, if metal. | | |
| 5. Removed plant. | | |
| 6. Made cuts with knife about 2 inches apart around root ball. | | |
| 7. Set plant in hole. | | |
| 8. Filled in hole until 2 to 2/3 full. | | |
| 9. Firmed soil around roots; watered. | | |
| 10. Added remaining soil to fill hole; watered again. | | |
| 11. Formed reservoir for future watering. | | |
| **NOTE:** Steps 12-14 are performed at teacher's discretion. | | |
| 12. Staked or guyed plant. | | |
| 13. Wrapped trunk, if needed. | | |
| 14. Fertilized plant according to manufacturer's instructions. | | |

| The student: | YES | NO |
|---|---|---|
| 15. Practiced safety rules throughout procedure. | ____ | ____ |
| 16. Performed steps in a timely manner. | ____ | ____ |
| 17. Provided satisfactory responses to questions asked. | ____ | ____ |
| 18. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Plant depth | 4 | 3 | 2 | 1 |
| Soil moisture | 4 | 3 | 2 | 1 |
| Reservoir | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

**AVERAGE RATING**

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**PRACTICAL TEST 7**

## INTRODUCTION TO TRANSPLANTING

## XVIII

**JOB SHEET 7**

**Heel-in bare-root stock.**

Student's name ____________________ Date __________

Evaluator's name ____________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Dug a V-shaped trench 12-18 inches deep. | ____ | ____ |
| 2. Placed trees or shrubs closely together and positioned them so tops pointed south. | ____ | ____ |
| 3. Used soil from trench to fill in around roots and lower part of plant. | ____ | ____ |
| 4. Pressed in soil gently with heel of shoe. | ____ | ____ |
| 5. Watered plants. | ____ | ____ |
| 6. Practiced safety rules throughout procedure. | ____ | ____ |
| 7. Performed steps in a timely manner. | ____ | ____ |
| 8. Provided satisfactory responses to questions asked. | ____ | ____ |
| 9. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

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______________________________________________

### PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Size and depth of trench | 4 | 3 | 2 | 1 |
| Placement of stock | 4 | 3 | 2 | 1 |
| Soil moisture | 4 | 3 | 2 | 1 |

### EVALUATOR'S COMMENTS

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**WRITTEN TEST**

# INTRODUCTION TO TRANSPLANTING

# XVIII

NAME ______________________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with transplanting to their correct definitions.** Write the correct numbers in the blanks.

___ 1. Tool used to make a small hole in soil for transplanting seedling

___ 2. Landscape plant materials grown in some type of container

___ 3. Injury or death of bark due to intense light

___ 4. Placing young plants temporarily in a trench to prevent their roots from drying out

___ 5. Method of bracing a tree using wire running at a 45 degree angle from the tree trunk to short stakes in the ground

___ 6. Covering the topsoil to reduce evaporation, cultivation, and erosion

___ 7. Measure of stem or trunk diameter or thickness 12 inches above soil line

___ 8. Tightly packed, intertwined roots

___ 9. A low-strength fertilizer used to help establish a plant's roots

___ 10. Tree or shrub for transplanting that has little or no soil around the roots

a. Sunscreen

b. Container stock

c. Tie-off

d. Rootbound

e. Starter fertilizer

f. Dibble

g. Ball and burlap

h. Water in

i. Guying

j. Sunscald

k. Staking

l. Mulching

m. Caliber

n. Heeling-in

o. Bare root

p. Caliper

q. Anchor fertilizer

r. Dapple

__11. Method of bracing a tree using wire running horizontally from the tree trunk to long stakes in the ground

__12. Tree or shrub with an undisturbed mass or soil remaining on the roots; wrapped in sacking and/or a wire basket

**OBJECTIVE 2** **Name five types of transplanted stock.**

**OBJECTIVE 3** **Name five factors to consider when transplanting trees and shrubs.**

**OBJECTIVE 4**

**Select from the following list examples of organic and inorganic mulches.** In part A, write an "X" in front of the mulches that are organic. In part B, write an "X" in front of the mulches that are inorganic. Remember that organic mulches will decompose and inorganic mulches will not.

**PART A**

Organic:

___ 1. Hay

___ 2. Clear plastic

___ 3. Wood chips

___ 4. Aluminum foil

___ 5. Asphalt

___ 6. Crushed glass

___ 7. Shredded bark

___ 8. Nut shells

___ 9. Cotton seed hulls

___ 10. Leaves

___ 11. Peat moss

**PART B**

Inorganic

___ 1. Weed barrier

___ 2. Black plastic

___ 3. Peat moss

___ 4. Sawdust

___ 5. Crushed stone

___ 6. Wood chips

___ 7. Leaves

___ 8. Aluminum foil

**OBJECTIVE 5**

**Select from a list reasons for mulching.** Write an "X" before each correct statement.

____1. Increase water runoff

____2. Prevent growth of weeds

____3. Reduce moisture evaporation

____4. Regulate soil temperature

____5. Prevent erosion

____6. Increase moisture evaporation

____7. Reduce plant growth

**OBJECTIVE 6**

**Select from a list true statements about comparisons between ball-and-burlap method and bare-root method.** Place an "X" before each true statement.

____1. Bare-root method can be done on any kind of plant, tree, or shrub

____2. Ball and burlap offers roots more protection than bare-root plants

____3. Bare-root plants have more protection than ball and burlap

____4. Ball-and-burlap method can be done on extremely large trees, whereas bare-root method can be done only on small plants

____5. Ball-and-burlap method takes less time than bare-root method; however, the digging process is more time consuming with ball-and-burlap method

____6. No materials are needed for ball-and-burlap method

____7. Materials such as nails, twine, wire baskets and container for soil ball are needed for ball-and-burlap method

____8. Bare-root method takes less time than ball-and-burlap method; however, digging process is more time consuming with bare-root method

**OBJECTIVE 7** **Describe advantages and disadvantages of transplanting container stock.**

Advantages:

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

Disadvantages:

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**NOTICE** **The following assignment sheets and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor.**

**OBJECTIVE 8** **Determine ball size.** SCORE ________

**OBJECTIVE 9**

**Demonstrate the ability to**

**a. Transplant seedlings from a flat into pots.** RATING_______

**b. Transplant rooted cuttings into pots.** RATING_______

**c. Ball and burlap a tree or shrub.** RATING_______

**d. Transplant balled-and-burlapped stock.** RATING_______

**e. Transplant a bare-root tree or shrub.** RATING_______

**f. Transplant container stock.** RATING_______

**g. Heel-in bare-root stock.** RATING_______

**WRITTEN TEST ANSWERS**

## INTRODUCTION TO TRANSPLANTING

## XVIII

**OBJECTIVE 1**

1. f
2. b
3. j
4. n
5. i
6. l
7. p
8. d
9. e
10. o
11. k
12. g

**OBJECTIVE 2**

Answers should include the following.

- Seedlings
- Rooted cuttings
- Bare-root stock
- Balled-and-burlapped stock
- Container stock

**OBJECTIVE 3**

Answers should include the following.

- Select the proper tree or shrub for the location
- Make sure soil is well-drained
- The best time to transplant bare-root stock is in early fall (usually between mid-February and mid-April)
- Deciduous trees and shrubs should be planted before new growth appears
- Ball-and-burlapped and container stock can be transplanted any time, but is usually done before spring

**OBJECTIVE 4**

PART A

1, 3, 7, 8, 9, 10, 11

PART B

1, 2, 5, 8

**OBJECTIVE 5** 2, 3, 4, 5

**OBJECTIVE 6** 2, 4, 5, 7

**OBJECTIVE 7** Answers should include the following.

Advantages:

- Container stock can be transplanted at any time so stock will be in bloom when desired
- Color of bloom on container stock can be seen at time of transplanting, ensuring correct selection of color
- Container stock is less expensive to produce than ball-and-burlap stock
- Transporting container stock is easier than transporting ball and burlap or bare-root stock
- Container stock does not require immediate transplanting
- Roots remain intact on container stock

Disadvantages:

- Transplanting container stock may be more difficult because can or container must be removed from stock
- Container stock can become rootbound if left in container too long

**OBJECTIVE 8** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 9** Refer to Practical Tests for Job Sheets 1 through 7.

**OBJECTIVE SHEET**

# INTRODUCTION TO PRUNING

## XIX

### INTRODUCTION

Pruning trees and shrubs is an important part of keeping them healthy and productive. When done incorrectly, pruning can ruin the appearance or harm the fruit and flowers of a tree or shrub. Trees or plants that are properly shaped when young will require less care as they grow older. Using the proper tools and making the proper cuts at the right time will help ensure a healthy and attractive plant in the years to come.

### UNIT OBJECTIVE

After completing this unit, the student should be able to identify pruning tools and their uses, identify tree structures, and make pruning cuts. The student will demonstrate these competencies by completing assignment sheet, job sheets, and the written test with a minimum of 85 percent accuracy.

### SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match terms associated with pruning to their correct definitions.
2. Select from a list reasons for pruning.
3. Match types of trees or shrubs to their proper pruning times.
4. Match tools used for pruning to their correct uses.
5. State rules for care of pruning equipment.
6. Match parts of a tree structure to their correct descriptions.
7. State reasons why specific parts of a tree should be pruned.
8. Determine which parts of a tree to prune. (Assignment Sheet 1)
9. Demonstrate the ability to
    a. Make a proper pruning cut with hand pruners. (Job Sheet 1)
    b. Make a proper pruning cut to a lateral bud. (Job Sheet 2)
    c. Remove a large branch from a tree. (Job Sheet 3)

## SUGGESTED ACTIVITIES

## INTRODUCTION TO PRUNING

## XIX

### PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Gather books, catalogs, pamphlets, charts, and posters that deal with pruning.
- Gather tools used for pruning.
- Arrange for guest speakers from a local nursery, garden center, or landscaping company to talk to the class about pruning.

  NOTE: Supply guest speakers with the objective sheet, information sheet, and any other components you want them to cover.
- Arrange for a field trip to an orchard or park where trees and shrubs are being pruned. A list of public gardens and arboretums in Oklahoma and vicinity is provided in Unit I, "Introduction to Horticulture."
- Decide how to administer pretest.

### DELIVERY

**Objective 1**

- Use information sheet to discuss terms and definitions associated with pruning, and show examples of the terms, if appropriate.
- Discuss which workers within the horticulture field would need to know various pruning methods.

**Objective 2**

- Use information sheet to discuss reasons for pruning and show the class pictures of well-pruned and poorly-pruned trees and shrubs.
- Take students to a nearby park or neighborhood to point out plants that have been pruned correctly, those that have been pruned incorrectly, and those that should be pruned.
- Discuss which plants require little pruning and which plants require extensive pruning. Note that some trees, such as fruit trees, are pruned annually.

**Objective 3**

- Use information sheet to discuss the proper pruning times for various trees and shrubs.
- Explain how pruning at improper times can damage a plant or keep it from flowering and bearing fruit.
- Show students examples of the trees and shrubs mentioned in the unit and go over correct pruning times.

**Objectives 4 and 5**

- Use information sheet to discuss and describe tools used for pruning.
- Provide students with examples of the tools and allow students to handle the tools.
- Ask students to go through various tool catalogs and point out how tools vary among manufacturers.
- Use "Introduction to Hand and Power Tools" to reinforce information on the tools and safe use of tools.
- Invite a landscaper or nursery worker to class to demonstrate the uses of the various tools.

**Objectives 6 and 7**

- Use information sheet to discuss the parts of a tree and how each is important.
- Bring in a piece of tree that shows its growth rings; explain what growth rings can tell about a tree.

- Take students outdoors and ask them to point out the various parts of a tree.
- Discuss which parts of a tree to prune and why.
- Show students what can happen to a tree if it is left unpruned.

### Objective 8

- Discuss how to make pruning cuts using various tools such as knives, hand pruners, saws, and pole saws.
- Show students examples or pictures of various trees and shrubs and ask them which pruning tool they would use for the job.
- Demonstrate how to use the tools, and allow students to practice various pruning tasks with the tools.
- Allow students to practice using the tools; make sure students are using the tools safely and properly.

## APPLICATION

### Objectives 8 and 9

- Have students complete Assignment Sheet 1, *Determine which parts of a tree to prune*, to give students practice in determining when a tree should be pruned to remain healthy.
- Use Job Sheets 1 through 3 to test student competency in pruning a tree.

  Job Sheet 1—*Make a proper pruning cut with hand pruners.*
  Job Sheet 2—*Make a proper pruning cut to a lateral branch.*
  Job Sheet 3—*Remove a large branch from a tree.*

## EVALUATION

### Practical test

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

### Written test

- Explain to students that they will be asked to demonstrate on the written test those actions listed in the specific objectives.

- Give written test.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest as necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## UNIT REFERENCES

- Allen, Oliver E. and the editors of Time-Life Books, *Pruning and Grafting*, Alexandria, Virginia: Time-Life Books, 1978.
- Cappiello, Paul E., *Controlling Plant Growth*, U5004A, Vocational Agriculture Service, College of Agriculture, University of Illinois, Urbana: n.d.
- Edinger, Philip and the editors of Sunset Books and Sunset Magazine, *Sunset Pruning Handbook*, Menlo Park, California: Lane Publishing Co., 1983.
- Engels, Jack E., *Ornamental Horticulture Principles and Practices*, Albany, New York: Delmar Publishers, 1985.
- Mitchell, Paul J., *Pruning Ornamental Trees and Shrubs*, Oklahoma State University Extension Facts, No. 6409, n.d.
- Williams, Jeff T., *How to Select, Use & Maintain Garden Equipment*, San Francisco, California: Chevron Chemical Company, 1981.

## INFORMATION SHEET | INTRODUCTION TO PRUNING | XIX

### OBJECTIVE 1

**Match terms associated with pruning to their correct definitions.**

- **Candle**—Immature growth on coniferous evergreens

  NOTE: Tight growth can be achieved by pinching new candles when they are approximately 2" long, removing half the candle.

- **Canopy**—The foliage of a tree; created by scaffold branches
- **Deciduous**—Plants that lose their leaves in the fall
- **Evergreens**—Plants that keep their foliage year round
- **Heading back**—Removing part of a branch down to a bud or side branch to control the direction of growth
- **Lateral bud**—Any bud below the terminal bud on a branch or twig
- **Pruning**—To cut dead or living parts from a plant in order to increase fruit or flower production, to improve form, or to remove dead or diseased parts
- **Scaffold branches**--The main branches forming the framework of a tree or shrub
- **Terminal bud**—Bud at the end of a branch or twig
- **Thinning out**—Removing an entire branch or shoot to maintain vigorous growth

### OBJECTIVE 2

**Select from a list reasons for pruning.**

- Remove dead, diseased, or injured parts

  NOTE: These create a point of entry for insects or organisms which can spread and kill a plant.

- Control size

  NOTE: Plants kept in their assigned places in a landscape can open a view or prevent wind and ice damage.

- Control shape

NOTE: Plants can be pruned to a *natural* form to keep the natural shape of the plant intact, or they can be pruned in a *geometric* form to create decorative shapes. Plants that are neatly pruned can enhance the appearance of a landscape.

- Improve production of fruit trees

Improve root and top growth balance when transplanting

- Control amount of shade

NOTE: A tree can be pruned to develop a dense or more open canopy.

- Renew vigor of old plants

NOTE: Pruning the top of a plant increases the vigor of remaining shoots by increasing the amount of water and nutrients the roots can supply to the remaining shoots.

**OBJECTIVE 3** **Match types of trees or shrubs to their proper pruning times.**

- Spring-flowering deciduous trees or shrubs—Prune after flowering, but before summer

EXAMPLES: Flowering crabapple, lilac, forsythia

- Summer-flowering deciduous trees or shrubs—Prune in early spring or when flowers fade in early fall

EXAMPLES: Crepe myrtle, althea

- Deciduous shade trees (flowers are insignificant)—Prune during any season

EXAMPLES: Oak

NOTE: Exceptions are "bleeders" which emit a clear sap if pruned between February 1 and new growth in spring. Examples of bleeders are maple, birch, and elm; these should be pruned in January or July.

- Broad-leaved evergreens—Prune just before new growth begins in spring

EXAMPLES: Nandina, boxwood, hollies

- Needle-leaved evergreens—Prune no more than half the length of the candle before new needles reach full size

EXAMPLES: Pine, fir, spruce

- Scale-leaved evergreens—Prune just before new growth begins in spring; growth can be shaped or controlled by pruning between May and July

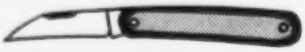
  EXAMPLES: Arborvitae, junipers

**OBJECTIVE 4**

**Match tools for pruning to their correct uses.**

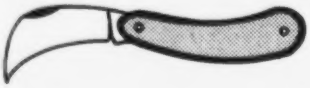
- **Pruning knives**—Used to remove small branches and clean up a pruning cut (Figures 1 and 2)

FIGURE 1



Single-folding blade

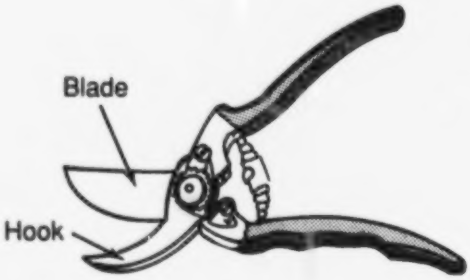
FIGURE 2



Heavy-duty hook blade

- **Hand pruners (scissors-type)**—Used to remove small branches no larger than a pencil (Figure 3)

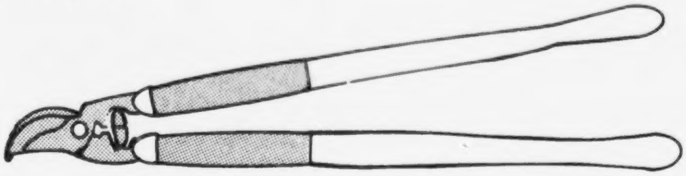
FIGURE 3



- **Lopping shears (loppers)**—Used to remove branches from pencil size to 1 1/4 inches in diameter (Figure 4)

  **NOTE:** Aluminum, steel, fiberglass, and wooden handles are available, but steel and wood are more durable. Select loppers with rubber pads on the inside of the handle to act as shock absorbers.

  FIGURE 4



- **Hedge shears**—Used to shape hedges and some evergreens (Figures 5, 6, and 7)

  EXAMPLES: Privet, arborvitae

  FIGURE 5

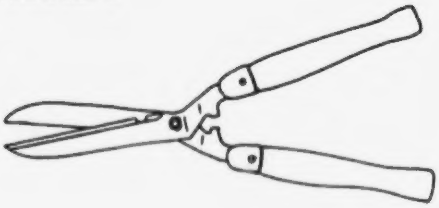
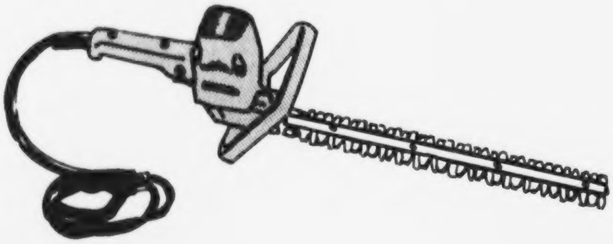
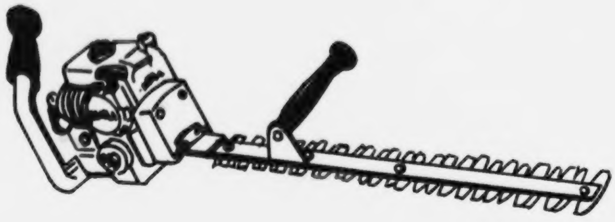


FIGURE 6



Electric hedge shears

FIGURE 7

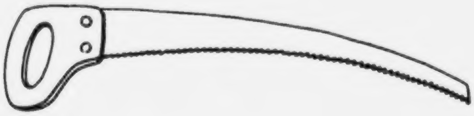


Gas-powered hedge shears

**NOTE:** Wear protective leather gloves and goggles when using electrical or gas-powered hedge shears.

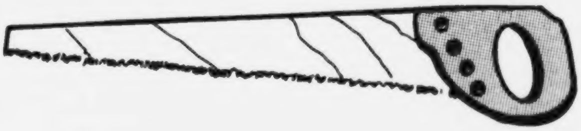
- **Pruning saws**—Used to remove branches larger than 1 1/4 inches in diameter (Figures 8-10)

FIGURE 8



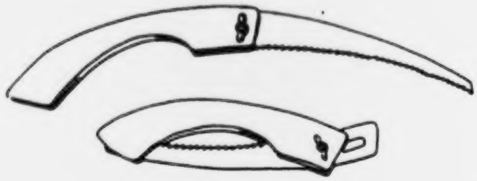
Curved blade

FIGURE 9



Straight blade

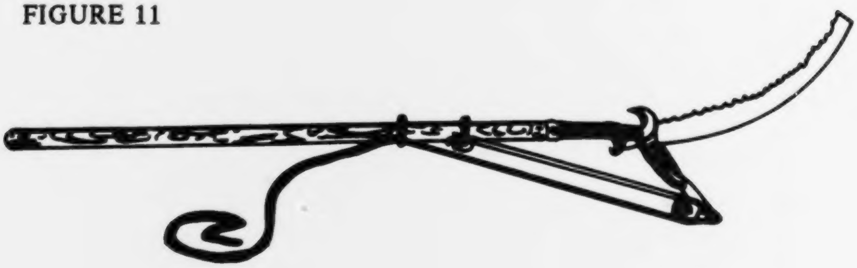
FIGURE 10



Folding saw

- **Pole pruners**—Used to remove branches that are out of reach (Figure 11)

FIGURE 11



NOTE: Chain saws are often used for large-scale removal. However, if proper pruning practices are used in early growth stages, chain saws will not be needed.

**OBJECTIVE 5** **State rules for care of pruning equipment.**

- Keep tools clean

  NOTE: If pruning tools are used on diseased wood, clean the blade with denatured alcohol or a bleach solution after each cut.

- Keep tools sharp

  NOTE: Plants can be torn or damaged if tools are not sharp.

- Keep tools properly adjusted

  NOTE: Blades out of alignment will crush stems and branches instead of cutting them.

- Oil tools often

- Select the proper tool for the job

  NOTE: Equipment can be ruined when forced to cut oversized branches.

- Do not twist tools when in use; this can cause blades to bend or lose alignment
- Handle tools carefully and safely
- Store tools away from children and weather

**OBJECTIVE 6** **Match parts of a tree structure to their correct description.** (Figure 12)

- **Trunk**—Part of the tree that connects the root system and branches
- **Scaffold**—Subdivision of the trunk; large branches
- **Leader**—Dominant growing point found in the top of a tree

  NOTE: If a double leader occurs, one must be removed for correct tree shape.

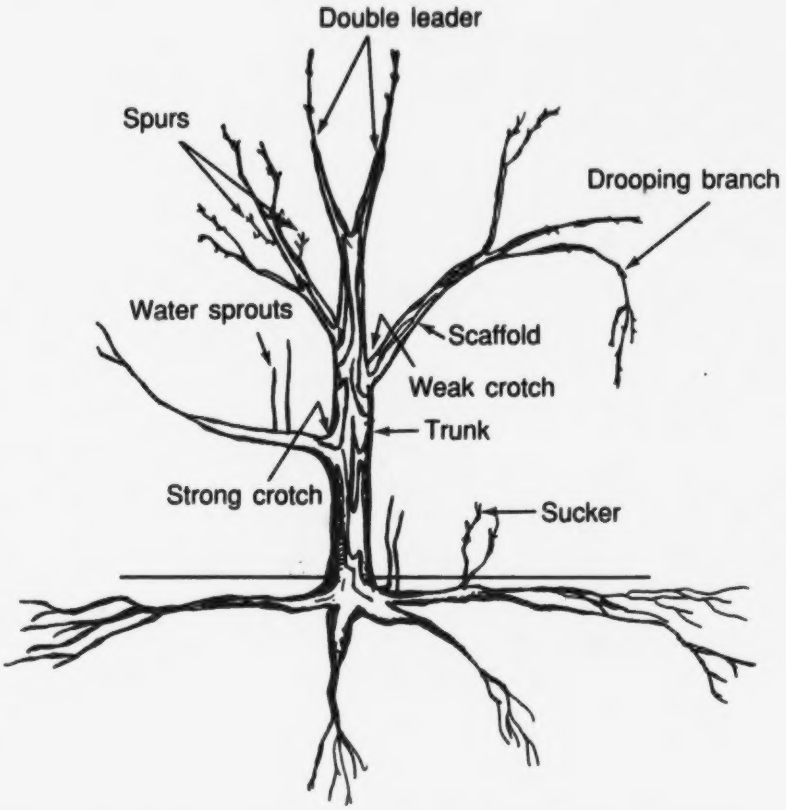
- **Spur**—Small branch that grows only 1/2 inch or less per year; site of fruit production in some trees

  NOTE: Spurs bear fruit and should not be removed from fruit trees.

- **Sucker**—Leafy shoot arising from roots or from the crown of the tree
- **Water sprout**—Vegetative shoot arising from buds on the trunk or large branches
- **Crotch**—Area where large branches join the trunk
- **Strong crotch**—A wide crotch angle that approaches a right angle
- **Weak crotch**—A crotch angle of less than 30 degrees

  NOTE: Weak crotches are subject to breakage

FIGURE 12


Double leader
Spurs
Drooping branch
Water sprouts
Scaffold
Weak crotch
Trunk
Strong crotch
Sucker

**OBJECTIVE 7**

**State reasons why specific parts of a tree should be pruned.** (Assignment Sheet 1)

- Dead, diseased, or injured parts—These can invite disease or decay

  NOTE: The cut should be made through the healthy wood between the trunk and affected area.

- Branches growing into the center of the tree—These can ruin the shape of the tree and crowd other branches
- Limbs growing from the crotch—These can crowd other branches and deprive them of sunlight
- Limbs growing across other branches—These can rub against each other and cause wounds

- Suckers—These rob the plant of water and nutrients
- Water sprouts—These parts are soft and may provide an entry point for pests
- Drooping branches—These are weak and slow-growing
- Parallel branches—These can rub against each other and cause wounds; the upper branch will also rob the other of sunlight

## ASSIGNMENT SHEET 1

## INTRODUCTION TO PRUNING

## XIX

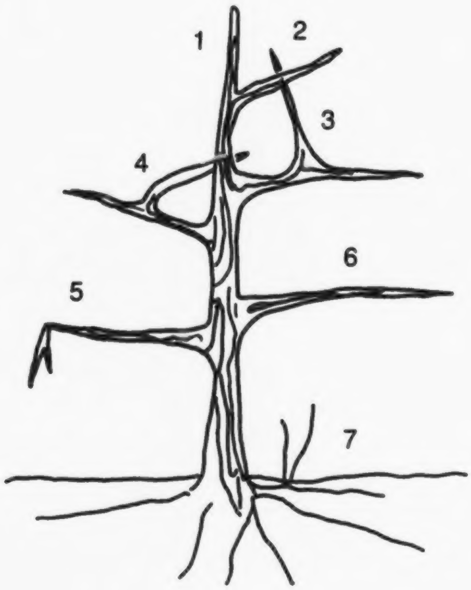
**OBJECTIVE 8** **Determine which parts of a tree to prune.**

**INTRODUCTION** Review the guidelines on the information sheet, Objective 7. There are eight parts of a tree that should be pruned to keep a tree healthy and attractive. For instance, limbs growing from the crotch of a tree, limbs growing across other branches, suckers and water sprouts should be removed.

**DIRECTIONS**

**PART I** Using the information you learned in Objective 7, determine which four parts numbered on the tree in the illustration below should be pruned. Tell why the part should be removed.

FIGURE 1



The parts to be pruned are

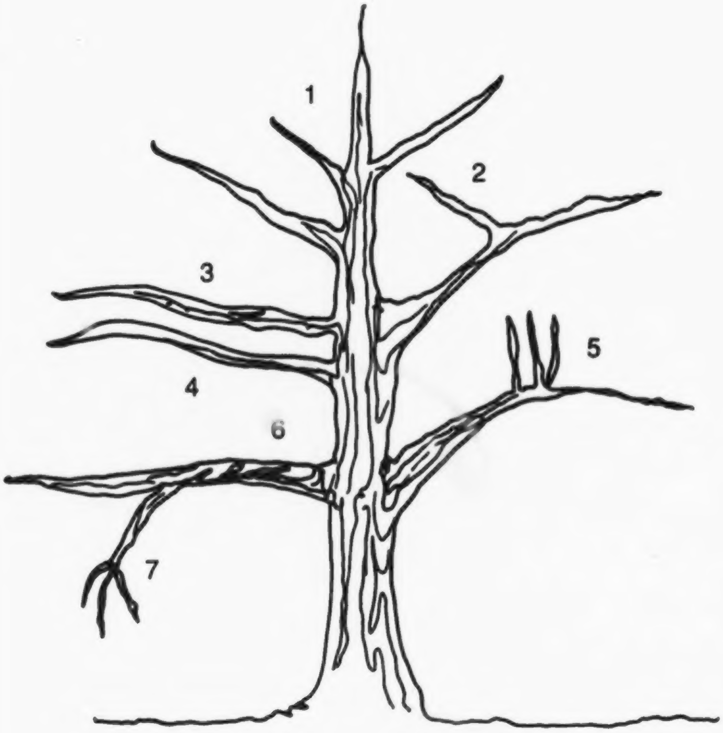
a. _______ Because:

b. _______ Because:

c. _______ Because:

d. _______ Because:

**PART II** Using the information you learned in Objective 7, determine which four parts numbered on the tree in the illustration below should be pruned. Then tell why the part should be removed.



The parts to be pruned are

a. ______Because:

b. ______Because:

c. ______Because:

d. ______Because:

**ASSIGNMENT SHEET 1**

PART I

a. 3; Because branches growing across other branches can rub against each other and cause wounds

b. 4; Because branches growing into the center of the tree can ruin the shape of the tree and crowd other branches

c. 5; Because injured branches can invite disease or decay

d. 7; Because suckers can rob the plant of water and nutrients

PART II

a. 2; Because branches growing into the center of the tree can ruin the shape of the tree and crowd other branches

b. 3 or 4; Because parallel branches can rub against each other and cause wounds; the upper branch will also rob the other of sunlight

c. 5; Because water sprouts may provide an entry point for pests

d. 7; Because drooping branches are weak and slow-growing

**JOB SHEET 1**

**Make a proper pruning cut with hand pruners.**

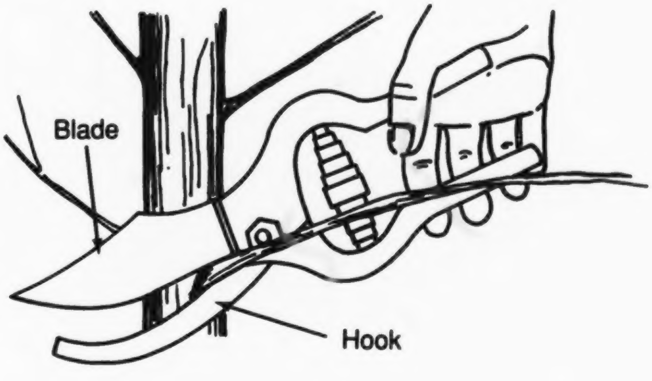
**EQUIPMENT AND MATERIALS**

- Hand pruners
- Plant for pruning
- Pruning knife, if needed

**PROCEDURE**

1. Hold pruners so that blade is above shoot and hook is below shoot. (Figure 1)

FIGURE 1



2. Push the shoot as far as possible into the open jaws of the pruners.
3. Place the blade flush against the main branch from which the shoot is to be cut.
4. Cut off the shoot in one clean stroke.
5. Do NOT twist the pruners; they may create a ragged edge and could throw the blades out of alignment.
6. Wipe off blade and hook.
7. Smooth the edges of the cut with a sharp knife, if needed.

8. Have instructor inspect your work.
9. Clean up work area and put away equipment and materials.

**JOB SHEET 2**

**Make a proper pruning cut to a lateral bud.**

**INTRODUCTION**

The way a cut is made influences the plant's future growth. If not properly done, pruning or cutting can destroy the natural shape of a plant and can lead to more problems, such as vulnerability to pests and diseases.

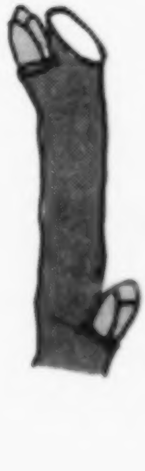
**EQUIPMENT AND MATERIALS**

- Hand pruners or loppers
- Plant to prune

**PROCEDURE**

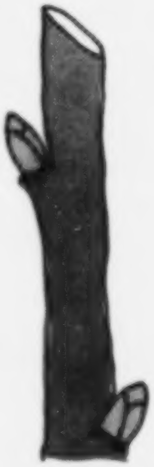
1. Select a bud aimed in the direction the new growth should go.
2. Position pruners or loppers slightly above the bud.
3. Hold pruners at a 45-degree angle to the stem and make a smooth cut; the end of the cut should be level with the base of the bud. (Figure 1)

FIGURE 1



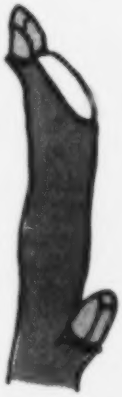
**NOTE:** Make sure the cut is not too far from the bud or too close to the bud. (Figures 2 and 3)

FIGURE 2



Cut too far from bud

FIGURE 3



Cut too close to bud

4. Have instructor evaluate your work.
5. Clean up work area and put away equipment and materials.

**JOB SHEET 3**

**Remove a large branch from a tree.**

## INTRODUCTION

One of the fears in removing a large branch is that the weight of the branch will cause it to fall before a clean cut is made, pulling some of the tree bark with it. Therefore, it is best to make two cuts on the limb before making the final cut. Care must also be taken not to cut too far from or too close to the trunk of the tree.

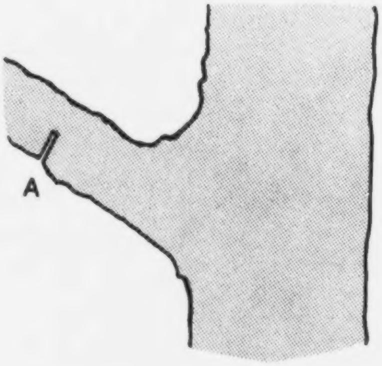
## EQUIPMENT AND MATERIALS

- Pruning saw
- Tree with large limb (more than 1 1/4 inches in diameter)
- Pruning knife, if needed

## PROCEDURE

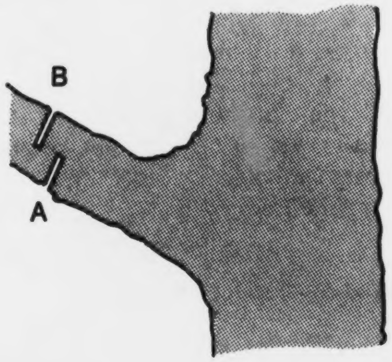
1. Make a cut 6 to 8 inches from the trunk, starting underneath the branch and cutting about half way through. (Figure 1)

FIGURE 1



2. Make a cut several inches beyond the first cut, cutting from the top of the branch; this should cause the limb to break off. (Figure 2)

FIGURE 2



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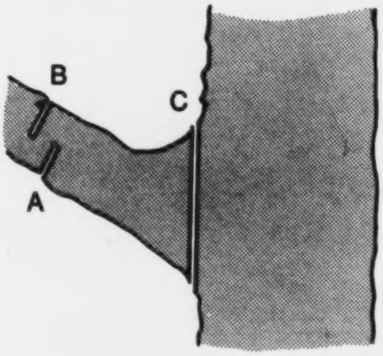
3. Make a third cut near the trunk, cutting from the top of the branch. (Figure 3)

FIGURE 3



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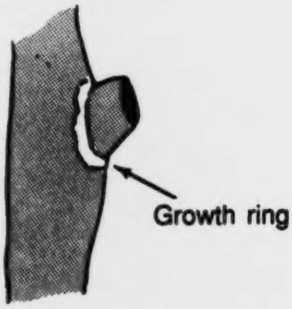
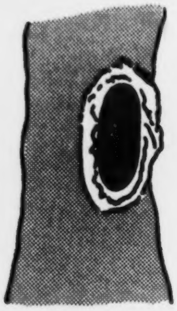
**NOTE:** Make sure the final cut is not too close or too far from the trunk. A stub that is too long will leave the tree vulnerable to insects and disease. A cut made too close to the trunk will die back into the tree. (Figures 4 and 5)

FIGURE 4



Stump is too long

FIGURE 5



Cut is too close

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4. Trim off ragged edges around wound with a pruning knife; seal the wound, if desired.

   **NOTE:** Cutting the wound into an oval shape will allow any moisture to drain out.

5. Have instructor evaluate your work.
6. Clean up work area and put away equipment and materials.

**JOB SHEET 1**

**Make a proper pruning cut with hand pruners.**

Student's name ________________________ Date __________

Evaluator's name ______________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Held pruners in proper position. | ____ | ____ |
| 2. Pushed the shoot as far as possible into the open jaws of the pruners. | ____ | ____ |
| 3. Placed blade flush against main branch. | ____ | ____ |
| 4. Cut off shoot cleanly. | ____ | ____ |
| 5. Did not twist pruners. | ____ | ____ |
| 6. Wiped off blade and hook. | ____ | ____ |
| 7. Smoothed edges of the cut, if needed. | ____ | ____ |
| 8. Practiced safety rules throughout procedure. | ____ | ____ |
| 9. Performed steps in a timely manner. | ____ | ____ |
| 10. Provided satisfactory responses to questions asked. | ____ | ____ |
| 11. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Position of cut | 4 | 3 | 2 | 1 |
| Edges of cut | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

______________________________________________

______________________________________________

______________________________________________

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**JOB SHEET 2**

**Make a proper pruning cut to a lateral bud.**

Student's name ________________________ Date __________

Evaluator's name ________________________ Attempt no. ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Selected a bud aimed in the direction the new growth should grow. | ____ | ____ |
| 2. Positioned pruners properly. | ____ | ____ |
| 3. Cut stem at a 45-degree angle, with end of cut level with base of bud. | ____ | ____ |
| 4. Practiced safety rules throughout procedure. | ____ | ____ |
| 5. Performed steps in a timely manner. | ____ | ____ |
| 6. Provided satisfactory responses to questions asked. | ____ | ____ |
| 7. Cleaned work area and put away tools. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

### PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Angle of cut | 4 | 3 | 2 | 1 |
| Edges of cut | 4 | 3 | 2 | 1 |

### EVALUATOR'S COMMENTS

### AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**PRACTICAL TEST 3**

## INTRODUCTION TO PRUNING

# XIX

**JOB SHEET 3**

**Remove a large branch from a tree.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. _____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Write a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Made a cut 6-8 inches from trunk, starting underneath the branch and cutting half way through. | _____ | _____ |
| 2. Made a cut several inches from the first cut, cutting from top of branch. | _____ | _____ |
| 3. Made a third cut near trunk, cutting from top of branch. | _____ | _____ |
| 4. Trimmed and sealed wound, if desired. | _____ | _____ |
| 5. Practiced safety rules throughout procedure. | _____ | _____ |
| 6. Performed steps in a timely manner. | _____ | _____ |
| 7. Provided satisfactory responses to questions asked. | _____ | |
| 8. Cleaned work area and put away tools. | _____ | _____ |

**EVALUATOR'S COMMENTS**

______________________________________________

______________________________________________

______________________________________________

## PRODUCT EVALUATION

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Placement of cut | 4 | 3 | 2 | 1 |
| Edges of cut | 4 | 3 | 2 | 1 |
| Sealing of cut | 4 | 3 | 2 | 1 |

## EVALUATOR'S COMMENTS

## AVERAGE RATING

**Evaluator note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

## PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**WRITTEN TEST**

# INTRODUCTION TO PRUNING

# XIX

NAME ______________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with pruning to their correct definitions.** Place the correct letters in the blanks.

___ 1. Plant that loses its leaves in the fall

___ 2. Any bud below the terminal bud on a branch or twig

___ 3. The foliage of a tree; created by scaffold branches

___ 4. Removing part of a branch down to a bud or side branch to control the direction of growth

___ 5. Bud at the end of a branch or twig

___ 6. Plant that keeps its foliage year round

___ 7. The selective removal of parts of a plant

___ 8. Immature growth on coniferous evergreens

___ 9. Removing an entire branch or shoot to maintain vigorous growth

___ 10. The main branches forming the framework of a tree or shrub

a. Evergreen

b. Deciduous

c. Pruning

d. Butchering

e. Culling

f. Heading back

g. Canopy

h. Candle

i. Terminal bud

j. Snipping

k. Rooting out

l. Thinning out

m. Lateral bud

n. Scaffold branch

o. Trimming down

**OBJECTIVE 2**

**Select from a list reasons for pruning.** Place a "T" in the blank before true statements and an "F" in the blank before false statements.

___ 1. Control amount of shade

___ 2. Allow plant to flower any time of year

___ 3. Renew vigor of old plants

____4. Control shape

____5. Decrease the life span of a plant

____6. Improve production of fruit trees

____7. Prevent leaves from dropping

____8. Remove dead, diseased, or injured parts

____9. Transform a tree into a dwarf variety

___10. Improve root and top growth balance when transplanting

___11. Control size

**OBJECTIVE 3**

**Match types of trees or shrubs to their proper pruning times.** Circle the letter of the answer that is MOST correct.

1. Prune broad-leaved evergreens.
   a. during any season
   b. just before new growth begins in spring
   c. after flowering, but before summer
   d. in early spring or when flowers fade in early fall
2. Prune spring-flowering deciduous trees and shrubs.
   a. after flowering, but before summer
   b. in early spring or when flowers fade in early fall
   c. just before new growth begins in spring; growth can be shaped or controlled by pruning between May and July
   d. during any season
3. Prune deciduous shade trees.
   a. in early spring or when flowers fade in early fall
   b. during any season
   c. just before new growth begins in spring
   d. when danger of frost is over

4. Prune summer-flowering deciduous trees and shrubs.
   a. during any season
   b. just before new growth begins in spring; growth can be shaped or controlled by pruning between May and June
   c. just before new growth begins in spring
   d. in early spring or when flowers fade in early fall

5. When pruning needle-leaved evergreens, remove.
   a. entire candle before new needles reach full size
   b. any new growth that appears in spring
   c. no more than half the length of the candle before new needles reach full size
   d. no more than one-quarter of the length of the candle before new needles reach full size

6. Prune scale-leaved evergreens.
   a. just before new growth begins in spring; growth can be shaped or controlled by pruning between May and July
   b. just before new growth begins in spring; growth can be shaped or controlled by pruning between September and November
   c. just after summer season is over; growth can be shaped or controlled any time of year
   d. during any season

**OBJECTIVE 4**

**Match tools used for pruning to their correct uses. Write the letter of the correct answers in the blanks.**

____1. Used to remove small branches no larger than a pencil

____2. Used to remove small branches and clean up a pruning cut

____3. Used to remove branches that are out of reach

____4. Used to shape hedges and some evergreens

____5. Used to remove branches from pencil size to 1 1/4 inches in diameter

____6. Used to remove branches larger than 1 1/4 inches in diameter

a. Pruning knives

b. Skill saw

c. Hand pruners

d. Hedge shears

e. Tree scissors

f. Carpenter's saw

g. Lopping shears

h. Grafting shears

i. Pruning saws

j. Pole pruners

k. Wire cutters

**OBJECTIVE 5**

**State five rules for care of pruning equipment.**

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

**OBJECTIVE 6**

**Match parts of a tree structure to their correct description. Place the correct letters in the blanks.**

___ 1. A crotch angle of less than 30 degrees

___ 2. Dominant growing point found in the top of a tree

___ 3. Small branch that grows only 1/2 inch or less per year; site of fruit production in some trees

___ 4. Part of the tree that connects the root system and branches

___ 5. Leafy shoot arising from roots or from the crown of the tree

___ 6. Subdivision of the trunk; large branches

___ 7. Vegetative shoot arising from buds on the trunk or large branches

___ 8. Area where large branches join the trunk

___ 9. A wide crotch angle that approaches a right angle

a. Trunk
b. Scaffold
c. Strong crotch
d. Crotch
e. Water sprout
f. Sucker
g. Nub
h. Spur
i. Acute crotch
j. Leader
k. Right crotch
l. Dissection
m. Weak crotch

**OBJECTIVE 7**

**State six reasons specific parts of a tree should be pruned.**

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

**NOTICE** The following assignment sheet and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 8** **Determine which parts of a tree to prune.** SCORE ________

**OBJECTIVE 9** **Demonstrate the ability to**

**a. Make a proper pruning cut with hand pruners** RATING ________

**b. Make a proper pruning cut to a lateral bud** RATING ________

**c. Remove large branch from a tree** RATING ________

# WRITTEN TEST ANSWERS | INTRODUCTION TO PRUNING | XIX

**OBJECTIVE 1**

1. b
2. m
3. g
4. f
5. i
6. a
7. c
8. h
9. l
10. n

**OBJECTIVE 2**

1. T
2. F
3. T
4. T
5. F
6. T
7. F
8. T
9. F
10. T
11. T

**OBJECTIVE 3**

1. b
2. a
3. b
4. d
5. c
6. a

**OBJECTIVE 4**

1. c
2. a
3. j
4. d
5. g
6. i

**OBJECTIVE 5**

Answer should include any five of the following

- Keep tools clean
- Keep tools sharp
- Keep tools properly adjusted
- Oil tools often
- Select the proper tool for the job
- Do not twist tools when in use; this can cause blades to bend or lose alignment
- Handle tools carefully and safely
- Store tools away from children and weather

**OBJECTIVE 6**

1. m
2. j
3. h
4. a
5. f
6. b
7. e
8. d
9. c

**OBJECTIVE 7**

Answers must include any six of the following:

- Dead, diseased, or injured parts—These can invite disease or decay
- Branches growing into the center of the tree—These can ruin the shape of the tree and crowd other branches
- Limbs growing from the crotch—These can crowd other branches and deprive them of sunlight
- Limbs growing across other branches—These can rub against each other and cause wounds
- Suckers—These rob the plant of water and nutrients
- Water sprouts—These parts are soft and may provide an entry point for pests
- Drooping branches—These are weak and slow-growing

- Parallel branches—These can rub against each other and cause wounds; the upper branch will also rob the other of sunlight

**OBJECTIVE 8** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 9** Refer to Practical Tests for Job Sheets 1 through 3.

**OBJECTIVE SHEET**

# INTRODUCTION TO VEGETABLES AND SMALL FRUITS

## XX

## INTRODUCTION

As a greenhouse or garden center employee, you will often answer customers' questions about growing fruits and vegetables. Some customers will be new gardeners who need information about types of growing structures and how to prepare the soil for common vegetables and small fruits. When they receive accurate, knowledgeable answers to their questions, they will have confidence in the quality of plants and services the greenhouse provides and will return when they need more plants. Perhaps you will even want to use the same information to start your own garden.

## UNIT OBJECTIVE

After completing this unit, the student should be able to describe the requirements of vegetable and small-fruit production including soil preparation and types of growing structures. The student will demonstrate these competencies by completing assignments sheets and the written test with a minimum of 85 percent accuracy.

## SPECIFIC OBJECTIVES

After completing this unit, the student should be able to

1. Match small fruits and vegetables to their proper classifications based on the part of the plant that consumers use.
2. Match plant types to proper classifications based on their hardiness (freezing temperature tolerance).
3. Describe physical factors and requirements for vegetable and small-fruit production.
4. Match types of growing structures to their correct descriptions.
5. Select true statements concerning goals of soil preparation.
6. Match methods of soil cultivation to their correct descriptions.
7. Distinguish between advantages of raised bed planting methods and advantages of flat bed planting methods.
8. Distinguish between advantages of direct seeding and advantages of transplanting.
9. List small fruits common to Oklahoma.

10. State similarities and differences in small-fruit cultures.

11. Look up information in Oklahoma State University Extension fact sheets. (Assignment Sheet 1)

12. Plan a small vegetable garden. (Assignment Sheet 2)

13. Plan a fruit garden. (Assignment Sheet 3)

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.
- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.
- Review teaching suggestions and plan classroom activities.
- Determine how you will schedule time for students to demonstrate competence in the required procedures.
- Order materials to supplement unit.
- Arrange to visit a commercial farm or pick-your-own farm.
- Invite a truck farm manager or commercial producer to speak to the class about soil preparation and fertilizers for vegetables and small fruit.
- Obtain samples of common vegetable and small fruit plants.
- Obtain pictures or identify locations of the types of growing structures.
- Obtain pictures of tools or bring samples of tools used in soil cultivation.
- Obtain samples of unprepared soil and prepared soil to demonstrate the differences. If possible, have students prepare small samples of soil by breaking up the clods, adding fertilizers and mulch, and mixing thoroughly.

## DELIVERY

**Objectives 1 and 2**

- Review the material from earlier units that applies to the physical factors and requirements for vegetables and small-fruit production.
- Have students determine the hardiness zone they live in.
- Have a commercial producer speak to the class about soil preparation and fertilizers.
- Distribute Supplements 1 through 4.

- Supplement 1 —OSU Fact Sheet Index
- Supplement 2—Fact Sheet 6004, *Oklahoma Garden Planning Guide*
- Supplement 3—Freezing Temperatures in Oklahoma
- Supplement 4—Approximate Composition of Some Common Organic Materials; Fertilizing Commercial Vegetables

- Have students complete Assignment Sheet 1—Look up information in Oklahoma State University Extension Fact Sheet.

**Objectives 3 through 5**

- Show pictures of types of growing structures or visit sites where these structures are located.
- Demonstrate prepared and unprepared soil and have the students prepare small samples of soil if possible.

**Objective 6**

- Show pictures of tools for soil cultivation and have students identify them. (See Unit III - *Hand and Power Tools*)

**Objectives 7 through 10**

- If possible, visit sites of raised bed planting techniques. Have students note the advantages they can observe.
- Show pictures or samples of common small fruits. Visit sites where these are growing. Have students note the growing conditions and the layout of the plots.

## APPLICATION

**Objectives 11 through 13**

- Use Assignment Sheet 1 to give students practice in looking up facts from OSU fact sheets.
- Use Assignment Sheet 2 to have students plan a small vegetable garden.
- Use Assignment Sheet 3 to have students plan a small fruit garden; use horticultural math skills and reinforce practical knowledge of pH values.

## EVALUATION

**Written test**

- Explain to students that on the written test they will be asked to demonstrate actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.
- Evaluate students on assignment sheet activities if not previously done.
- Reteach and retest if necessary.
- Complete appropriate section of competency profiles.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *How to Design and Build a Vegetable Garden*. 1/2" VHS, color 53 min., 1988, Burpee. Covers (1) Select the right garden site, (2) Design an efficient, space-saving raised bed layout, (3) Test and prepare the soil for optimum fertility and drainage, (4) Build a high-yield low-maintenance boxed raised bed growing system, (5) Turn vegetable beds into miniature, season-extending greenhouses in just minutes, (6) Double your growing area with a trellis system, (7) Make your own high-quality compost, (8) Install a drip irrigation system, (9) Use mulch to control soil temperature and eliminate weeding, (10) Incorporate gardening devices, (11) Select, plant, and manage your vegetable crops to maximize productivity. Order No. V150.
- *How to Grow Cool-Weather Plants*. 1/2" VHS, color, 57 min., 1988, Burpee. Covers (1) Select cool-weather crops, (2) Raise seedlings (3) Prepare soil, (4) Use dual-mulching system and tunnels, (5) Use extensive planting techniques and vertical trellises, (6) How to fertilize, (7) Install a drip system, (8) Use a pest management system (9) Right time for harvest. Order No. V148.
- *How to Grow Warm-Weather Plants*. Covers how to (1) Avoid common mistakes in selecting vegetables (2) Grow seedlings that resist transplant shock, (3) Set up a trellis system, (4) Use plastic and organic mulch, (5) Use proven watering techniques, (6) Fertilizers, (7) Pest management, (8) Right time for harvest. Order No. V149.

**NOTE:** These videotapes are available to Oklahoma teachers on a free loan basis. Contact the Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Ave., Stillwater, Oklahoma 74074, or telephone 1-800-522-5810.

## UNIT REFERENCES

- Ball, Vic ed., *Ball Redbook: Greenhouse Growing*, 14th. ed. Reston Virginia: Reston Publishing Co., 1985.
- De Saulles, Denys *Home Grown*. Boston: Houghton Mifflin, 1988
- *Growing Vegetables in the Home Garden*. USDA, Home and Garden Bulletin Number 202, 1985.
- Lorenz, Oscar and Maynard, Donald N. *Knotts Handbook For Vegetable Growers*, Second Edition. New York: John Wiley and Sons, 1980.

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## INFORMATION SHEET

## INTRODUCTION TO VEGETABLES AND SMALL FRUITS

## XX

**OBJECTIVE 1**

**Match small fruits and vegetables to their proper classifications based on the part of the plant that consumers use.**

NOTE: Some plants, such as onions and turnips, may fit into more than one classification.

- Grown for their stems and leaves

cabbage
broccoli
asparagus
cauliflower
celery

- Grown for their fleshy storage organs

potatoes
beets
carrots
onions
leeks

- Grown for their seeds and fruits

tomatoes
cantaloupe
strawberries
peppers
watermelon

**OBJECTIVE 2**

**Match plant types to proper classifications based on their hardiness (freezing temperature tolerance).**

- **Very hardy**—Planted 4 to 6 weeks before average first frost-free date.

asparagus
cabbage
collards
horseradish
kohlrabi
mustard
peas
rhubarb
spinach
broccoli
chives
garlic
kale
leek
parsley
radish
onion
turnip

- **Frost tolerant**—Planted 2-3 weeks before average first frost-free date.

  beet
  cauliflower
  chard
  Chinese cabbage
  lettuce
  salsify
  radish
  mustard
  carrot
  celery
  chicory
  endive
  potato
  parsnip
  herbs

- **Tender**—Planted around average first frost-free date

  cowpea
  soybean
  tomato
  New Zealand spinach
  snap bean
  sweet corn
  summer squash

- **Warm-loving**—Planted 1-2 weeks after average first frost-free date

  cucumber
  lima bean
  okra
  sweet pepper
  winter squash
  watermelon
  eggplant
  mushmelon
  hot pepper
  pumpkin
  sweet potato

**OBJECTIVE 3**

**Describe physical factors and requirements for vegetable and small-fruit production.**

- **Sunlight**—Smaller plants should not be blocked by larger vegetables, shrubs, or trees. In gardens with east-west rows, tallest plants should be planted to the northern-most end of a garden.
- **Plant hardiness**—Plants are divided in to hardiness classifications based upon their ability to survive a frost; warm-loving plants should not be planted too early in spring or cool-loving plants too late into summer.
- **Soil preparation**—Maintains soil fertility and controls plant pests. Includes proper cultivation and addition of organic matter which helps hold water, reduces compaction, and allows aeration.

**NOTE:** Properly prepared soil, which provides a desirable medium for root development, absorbs water and air rapidly, and usually does not form a crust on the surface is referred to as good soil tilth.

- **Pest control**—Includes control of insects, fungi, bacteria, viruses, nematodes, rabbits, birds, deer, squirrels, moles, etc.
- **Weed control**—Removing weeds by physical or chemical means reduces competition for nutrients, moisture, and light.
- **Water**—Proper amount and timing of water is important; only water held in suspension in the soil is useful to the root system.
- **Fertilizers**—Plant production and quality depends on correct amounts, proper balance, and timing of application.

**OBJECTIVE 4**

**Match types of growing structures to their correct descriptions.**

- **Hot beds**—Used primarily to start early plant growth in the spring; functions as a miniature greenhouse and is heated by the sun and an underground heat source

FIGURE 1

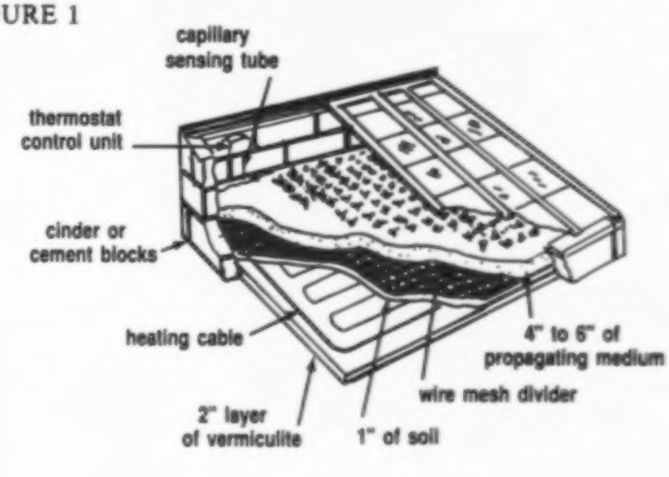

capillary sensing tube
thermostat control unit
cinder or cement blocks
heating cable
4" to 6" of propagating medium
wire mesh divider
2" layer of vermiculite
1" of soil

Illustration reprinted with permission of Texas A & M, 1985.

- **Cold frames**—Similar to the hot-bed but is used as a temporary place for plants being transferred from greenhouse to the outdoors

FIGURE 2

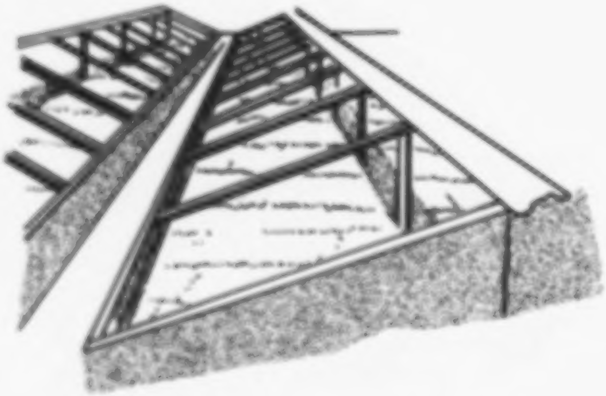


Illustration reprinted with permission of Texas A & M, 1985.

- **Tunnels**—Plastic-covered rows of plants growing in the ground

FIGURE 3

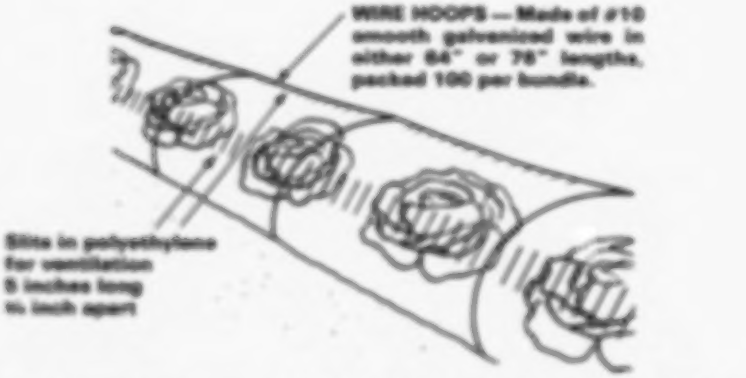

WIRE HOOPS — Made of #10 smooth galvanized wire in either 64" or 76" lengths, packed 100 per bundle.
Slits in polyethylene for ventilation 5 inches long ¾ inch apart

Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Floating row covers**—Wide sheets of plastic or cloth material that are placed over entire crop or plot of vegetables to provide insulation

  EXAMPLES: Plastic or cloth

  **NOTE:** Cover floats on top of plants.

- **Greenhouse**—Glass or plastic-covered houses for starting or growing plants

- **Hot caps**—Small paper or plastic covers used to keep individual plants warm during spring or fall nights and cool weather

  FIGURE 4

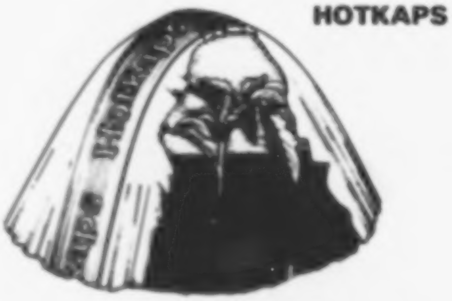
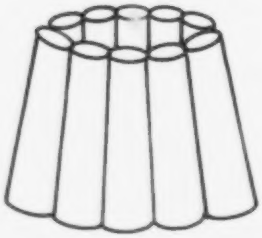


Illustration reprinted with permission of A.H. Hummert Seed Company, St. Louis, MO.

- **Water caps**—Plastic covers for individual plants; side pockets hold water that absorbs heat during the day and releases it during the cool of the night, and warms plant in cool weather

FIGURE 5 (Water caps)



**OBJECTIVE 5** **Select true statements concerning goals of soil preparation.**

- **Breaking up clods**—Allows better mix of humus, water, and air in the soil, and helps prevent weed growth.
- **Aeration**—Allows air to dry out the roots and prevents rotting.
- **Incorporating organic matter**—Releases nitrogen, minerals, and other nutrients for plant use; also aids in retention of water.
- **Fertilization**—Provides vital elements needed for plant growth; composition and rate of application depends on locality, soil, crops and timing of application.

**OBJECTIVE 6** **Match methods of soil cultivation to their correct descriptions.**

- **Plow**—Turns soil over, digging about 8 inches deep

FIGURE 6 (Plow)

- **Harrow and disc harrow**—Breaks up clods and levels soil

FIGURE 7

Illustration reprinted with permission of Rn Manufacturing, Ltd.

Harrow

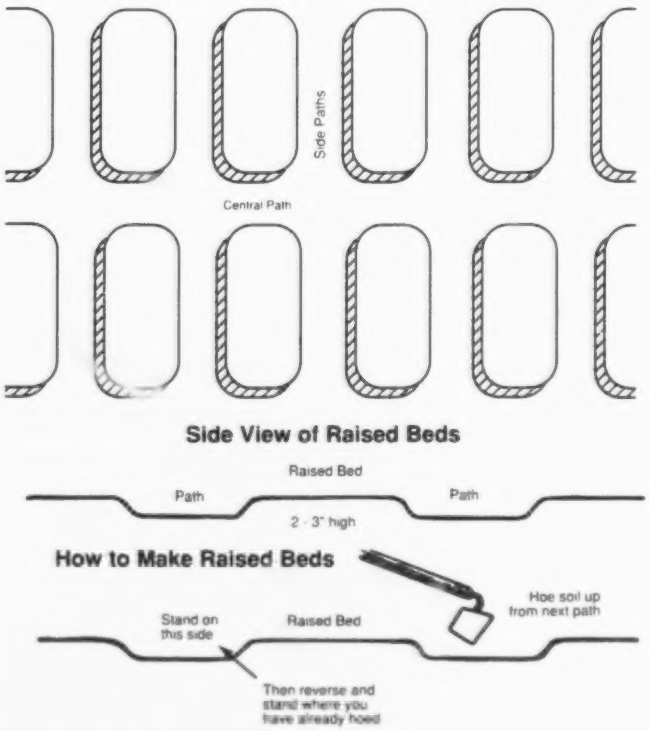
Disc harrow

- **Shovel**—Used for small garden work only

**OBJECTIVE 7** **Distinguish between advantages of raised-bed planting methods and advantages of flat bed planting methods.**

- **Raised beds**—Growing beds built up higher than the average soil level, usually includes organic materials to loosen soil.

FIGURE 8


Side Paths
Central Path
Side View of Raised Beds
Raised Bed
Path
Path
2 - 3" high
How to Make Raised Beds
Hoe soil up from next path
Stand on this side
Raised Bed
Then reverse and stand where you have already hoed

- **Flat beds**—Standard methods of cultivation and planting in flat soil.

**Advantages of raised beds**

- Soil warms faster
- Plants are in production sooner
- Better drainage in wet soils

- Looser soil for root crops
- Seeds won't wash into hard soil
- Clay soil stays more workable
- Beds don't bake down
- Easy to irrigate
- Soil stays soft all year
- Better aeration
- No erosion problems

**Advantages of flat beds**

- More adaptable to block planting (broadcast planting)

  **NOTE:** Broadcast spreaders are used to throw seeds in a wide circle rather than drop seeds in a row.

- Require less labor

**OBJECTIVE 8** **Distinguish between advantages of direct seeding and advantages of transplanting.**

- **Direct planting**—Seeds placed directly into soil at planting time

  **NOTE:** Crops grown by direct planting: corn, melon, beans, beets, peas, lettuce, carrots; some trees and shrubs

  **Advantages of direct planting**

  - Lower cost
  - Requires less labor
  - Seeding operation is faster
  - Later crops
  - No labor in filling flats, mixing potting medium, seeding, watering, and transplanting
  - No expense in pots, flats, soil mix, watering systems, fertilizers, shelter
  - Best for plants that do not transplant well (vine crops such as cucumbers, watermelons)

  - Most economical for most root crops except sweet potatoes

- **Transplanting**—Plants are started in the greenhouse or cold frame rather than being planted directly into soil

  **NOTE:** Crops typically transplanted are tomatoes, peppers, strawberries, seedless watermelons.

  **Advantages of transplanting**

  - Bigger plants earlier
  - Best for plants that are hard to germinate in soil
  - Higher germination rate
  - Uniform plant spacing
  - No thinning required
  - Early weed control not necessary

**OBJECTIVE 9** **List small fruits common to Oklahoma.**

- Strawberries
- Blueberries
- Blackberries
- Raspberries
- Grapes

**OBJECTIVE 10** **State similarities and differences in small-fruit cultures.**

**NOTE:** Small fruits covered in this section are those listed in Objective 9.

**Cultures preferred by all fruits**

- Full sun
- Well-drained, slightly acidic soil
- Added organic matter

**Cultures preferred by specific fruits**

- Strawberries—Prefer rich, sandy loam with constant source of water for shallow roots
- Blueberries—None
- Blackberries—Need soil that retains large amounts of water; do not like sandy soils
- Raspberries—Can tolerate cold temperatures but dislike wide fluctuations in temperature
- Grapes—Prefer rich sandy loam

## Horticulture

| | | |
|---|---|---|
| 6000 | Fertilizing Commercial Vegetables Crops | 6-87 |
| 6004 | Oklahoma Garden Planning Guide | 1-87 |
| 6005 | Mulching Garden Soils | Rev 5-88 |
| 6007 | Improving Garden Soil Fertility | 2-84 |
| 6008 | Weed Control in Vegetables | Rev 1-88 |
| 6009 | Fall Gardening | 2-84 |
| 6012 | Growing Tomatoes in the Home Garden | Rev 2-88 |
| 6013 | Summer Care of the Home Vegetable Garden | 2-84 |
| 6014* | Making a Compost Pile | 2-84 |
| 6015 | Weed Control in the Home Garden | 2-84 |
| 6016* | Asparagus Culture in the Home Garden | 4-81 |
| 6018 | Asparagus | AF 1-85 |
| 6019 | Commercial Production of Fresh Market Tomatoes | 2-87 |
| 6020 | Growing Vegetable Transplants | 2-84 |
| 6021 | Sweet Corn Production | AF 10-82 |
| 6022* | Sweet Potato Production | AF 1-85 |
| 6023 | Slicing Cucumber Production | AF 12-82 |
| 6024 | Snap Bean Production | AF 11-82 |
| 6025 | Okra Production | AF 12-82 |
| 6026 | Squash and Pumpkin Production | AF 2-83 |
| 6027* | Production of Cabbage, Cauliflower, Broccoli & Brussel Sprouts | AF 2-83 |
| 6028 | Potato production | 6-87 |
| 6029 | Southern Pea Production | 5-87 |
| 6030 | Pepper Production | Rev AF 9-85 |
| 6031* | Greens Production (Spinach, Turnip, Mustard and Collard) | AF 7-83 |
| 6032 | Vegetable Varieties for Oklahoma | 2-86 |
| 6200 | A Calendar for Pecan Growers | 12-82 |
| 6201 | Pecan Varieties for Oklahoma | 8-85 |
| 6204 | Bark Grafting Pecans | 2-84 |
| 6205 | Splice and Tongue Grafting Pecans | 12-82 |
| 6206 | Patch Budding Pecans | 7-78 |
| 6207 | Starting Pecan Trees | 3-87 |
| 6208* | Improving Native Pecan Groves | 2-84 |
| 6209 | Pecan Insect and Disease Control 1988 | Rev CR 4-88 |
| 6210 | Recommended Apple and Peach Varieties | 5-85 |
| 6211 | Propagation of Fruit and Nuts by Seed | 12-78 |
| 6214 | Growing Strawberries in the Home Garden | 4-84 |
| 6216 | Soils for Fruit Trees | 2-84 |
| 6217 | Collecting and Storing Pecan Propagation Wood | 2-84 |
| 6218 | Peanuts in the Home Garden | Rev 1-88 |
| 6221 | Grape, Blackberry and Strawberry Insect and Disease Control - 1988 | Rev CR 4-88 |
| 6222* | Home Fruit Planting Guide | 2-84 |
| 6227 | Propagating Peaches by "T" Budding | 12-82 |
| 6228 | Annual Pruning of Fruit Trees | Rev 3-88 |
| 6229 | Pollination Requirements for Fruits and Nuts | 3-77 |
| 6230 | Four-Flap Grafting of Pecans | 2-84 |
| 6232 | Fertilizing Pecan and Fruit Trees | 2-84 |
| 6235* | Home Fruit Spray Schedules | 4-87 |
| 6236 | Watermelon Production | AF 6-83 |
| 6237 | Cantaloupe Production | AF 1-83 |
| 6238* | Strawberry Production in Oklahoma | AF 4-85 |
| 6239 | Commercial Blackberry Production in Oklahoma | AF 2-83 |
| 6240 | Commercial Peach and Nectarine Insect and Disease Control - 1988 | Rev CR 4-88 |
| 6241 | Commercial Apple Insect and Disease Control - 1988 | Rev CR 4-88 |
| 6242 | Weed Control in Pecans, Apples and Peaches | CR 8-86 |
| 6243 | Weed Control in Small Fruit Crops | 3-87 |
| 6400* | Roses in the Landscape | 10-84 |
| 6403 | Rose Culture in Oklahoma | 10-84 |
| 6404 | Winter Protection for Landscape Planting | Rev 10-86 |
| 6407* | Flower Arrangements | 2-84 |
| 6408 | Landscape Maintenance Schedule | Rev 12-86 |
| 6409 | Pruning Ornamental Trees and Shrubs | 7-85 |
| 6411 | House Plant Care | 3-84 |
| 6412 | Fertilizing Shade and Ornamental Trees and Shrubs | 12-86 |
| 6413 | Poinsettias | AF 12-80 |
| 6414 | Planting Shade Trees and Shrubs | 1-87 |
| 6415 | Training Young Shade and Ornamental Trees | AF 9-85 |
| 6416 | Shade & Ornamental Tree Appraisal | Rev AF 4-88 |
| 6417* | Landscaping for Energy Conservation | AF 9-85 |
| 6418* | Selecting a Lawn Grass for Oklahoma | 5-85 |
| 6419* | Establishing a Lawn in Oklahoma | 9-85 |
| 6420* | Lawn Management in Oklahoma | 9-85 |
| 6421* | Controlling Weeds in Home Lawns | 9-85 |
| 6422 | 1985 Partial Listing of Herbicides, Registered in OK for Use on Turf | CR 8-85 |
| 6423* | Controlling Grassy Weeds in Home Lawns | 9-85 |
| 6600 | Turfgrass Management of Bermudagrass Football Fields | 7-87 |

## Insects

| | | |
|---|---|---|
| 7000 | Beef Cattle Parasite Controls | 8-82 |
| 7001 | Common Ticks of Oklahoma | Rev 2-87 |
| 7004 | External Poultry Parasite Controls | 3-83 |
| 7005 | Sheep and Goat Insect Pest Control | Rev 7-87 |
| 7006 | Summer Ticks on Beef Cattle | 1-80 |
| 7007 | Biology and Control of the Face Fly | 3-84 |
| 7008 | Human Lice and Scabies | 2-80 |
| 7009* | Biology and Control of Cattle Lice | 2-83 |
| 7010 | Ticks and Fleas in Homes, Lawns and on Pets | Rev 5-88 |
| 7012 | Mosquito Control | Rev 5-88 |
| 7013 | Rodents and Their Control in and Around Dwellings | 11-85 |
| 7014 | Horse External Parasite Control Suggestions | CR 11-88 |
| 7015 | Horse External Parasite Control Series Part 1 | 11-88 |
| 7016 | Horse External Parasite Control Series Part II | 11-88 |
| 7150 | Alfalfa Forage Insect Control | 7-84 |
| 7151* | Strip Cropping Cotton and Sorghum for Bollworm Control | CR 3-73 |
| 7153* | Identifying Oklahoma Cotton Pests | 3-66 |
| 7154* | Worm Pests of Oklahoma Cotton | 3-66 |
| 7155 | Nectar and Pollen Plants of Oklahoma | 3-74 |
| 7156 | Field Key to Larvae in Soybeans | 2-74 |
| 7157 | Field Key to Larvae in Sorghums | 5-79 |
| 7158 | Field Key to Larvae in Peanuts | 2-74 |
| 7159 | Field Key to Larvae in Alfalfa | 2-74 |
| 7160 | Field Key to Larvae in Corn | 7-79 |
| 7161 | Field Key to Larvae in Cotton | 2-74 |
| 7162 | Cotton Insect Control - 1984 | 3-84 |
| 7163 | Field Key to Larvae on Pecans | Rev 11-86 |
| 7164 | Field Key to Beetles in Pines | 8-81 |
| 7165* | Nematode Control in Peanuts | CR 5-71 |
| 7167 | Soybean Insect Survey and Control in Oklahoma | 3-84 |
| 7168 | Plant Galls Caused by Insects | 3-84 |
| 7169* | Potato Disease Prevention and Control | 5-79 |
| 7170 | Control of Sorghum Insects | Rev 7-85 |
| 7171 | Sequential Sampling of the Cotton Fleahopper in Oklahoma | CR 7-79 |
| 7172* | Sequential Sampling of the Boll Weevil in Oklahoma | CR 12-80 |
| 7174 | Peanut Insect Control in Oklahoma (Pest Management Series) | 4-84 |
| 7175* | Sampling Methods for Adult Pecan Weevils | 3-80 |
| 7176 | Insects on Small Grains and Their Control | Rev 3-87 |
| 7177 | Sampling for the Alfalfa Weevil in Oklahoma (Pest Mgmt. Series) | Rev CR 12-86 |
| 7178* | Oklahoma Peanut Disease Loss Estimates for 1979 | CR 3-80 |
| 7179 | Integrated Control of the Alfalfa Weevil | CR 10-82 |
| 7180 | Stored Grain Insect Control in Oklahoma | Rev 3-87 |
| 7181 | Sequential Sampling for Predators in Cotton | CR 6-83 |
| 7182 | OK Cone Trap Procedure for Timing Insecticide Applications for Pecan Weevil | 3-84 |

Courtesy of Oklahoma State University Cooperative Extension Service

# Oklahoma Garden Planning Guide

OSU
Extension
Facts

Cooperative Extension Service • Division of Agriculture • Oklahoma State University

No. 6004

**Jim Gallott**
Extension Horticulturist

Well-planned, properly managed home gardens can furnish Oklahoma families with flavorful, high quality fresh vegetables from spring through fall, as well as for processing or storing for winter.

The amount of money invested in seeds, fertilizer, pesticides and a few tools is more than offset by the enjoyment, healthful outdoor exercise and fresh "home-grown" flavor.

## Choosing the Site

The selection and preparation of the garden site is an important key to growing a home garden successfully. An area exposed to full or near full sunlight with deep, well-drained, fertile soil is ideal. While many urban gardeners have little choice as to site selection, by modifying certain cultural practices and types of crops grown, many sites can be utilized successfully. It is very important that the garden be located near a water supply and away from trees and shrubs that would compete for light, water and nutrients.

## Planning the Garden

The accompanying chart should be of help in determining family requirements of the different vegetables.

Perennial vegetables (asparagus, rhubarb, winter onions, etc.) should be planted at one side or end of the garden for efficient operation. The hardy vegetables planted early in the season should be planted together so they may be followed with late season plantings of the same or other vegetables. Vegetables requiring similar cultural practices should be grouped together for ease of care.

The chart groups vegetables as cool season or warm season crops, indicating under which conditions they grow best. Crops classed as cool season may be planted earlier in the season and thrive best under cool conditions, while those grouped as warm season crops grow better during warm temperatures.

Based on the temperature that the plants will withstand, vegetables are hardy, semi-hardy, tender or very tender. Hardy types may be planted before the last killing frost. The semi-hardy ones will be injured by a hard frost but will grow in cool weather and not be harmed by a light frost. Tender plants are injured or may be killed by a light frost but can withstand cool weather, while the very tender are injured by cool weather.

Differences in suggested planting dates range from the earliest for southeast Oklahoma to the latest for the northwest part of the state.

Seeds remaining after planting may be stored in a refrigerator or food freezer. Seeds so stored may remain viable for many (10-20) years. In order to avoid contamination by seed treatment chemicals, store seed packets in a plastic container.

## Gardening Tips

In order to have a successful garden, the gardener must follow a few rules. The following tips may help to prevent some common garden problems from occurring, or help overcome those that do arise:

- Sample soil and have it tested every three to four years.
- Apply fertilizers to garden area in recommended manner and amount.
- Make use of organic materials such as animal manure and compost where available.
- Use recommended varieties.
- Thin plants when small.
- Use mulches to conserve moisture, control weeds and reduce fruit rots.
- Avoid excessive walking and working in the garden when foliage and soil are wet.
- Examine garden often to keep ahead of potential problems.
- Keep garden free of weeds, insects and diseases.
- Wash and clean tools and sprayers after use.
- Rotate specific crop locations each year to avoid insect and disease buildup.
- When possible harvest vegetables during the cool hours of the day.

## Avoid the Following Mistakes:

- Planting too closely, which prevents walking or working in the garden.
- Placing fertilizer directly in contact with plant roots or seeds.

- Cultivating deeply, resulting in injury to plant roots.
- Depending on varieties not recommended for your area; do try new releases, however.
- Watering frequently or excessively so that the soil is always wet and soggy.
- Allowing weeds to grow large before elimination.
- Applying chemicals or pesticides in a haphazard manner, without reading label directions or proper mixing.
- Using chemicals not specifically recommended for garden crops.
- Storing left-over diluted spray.

## Garden Planning Guide

| Vegetable | Time To Plant* | Feet of Row Per Person | Days to Harvest | Method of Planting | Spacing Between Rows | Spacing Within Rows | Depth to cover Seed | Quantity Needed Per Person | Frost Tolerance |
|---|---|---|---|---|---|---|---|---|---|
| Cool Season<br>Asparagus | Fall or Spring | 10-20 | — | Crowns | 4 ft. | 2 ft. | 6 in. | 3-5 | Hardy |
| Beet | March | 10-20 | 50-70 | Seed | 1½ ft. | 4 in. | 1 in. | ½ oz. | Semi-Hardy |
| Broccoli | March | 10 | 80-90 | Plants | 3 ft. | 1½ ft. | | 6-7 plants | Hardy |
| Cabbage | Feb. 15 to March 10 | 10-20 | 80-90 | Plants | 3 ft. | 1-1½ ft. | | 6-15 plants | Hardy |
| Carrot | Feb. 15 to March 10 | 20 | 70-80 | Seed | 1½ ft. | 3 in. | ½ in. | ¼ oz. | Semi-Hardy |
| Cauliflower | Feb. 15 to March 10 | 15 | 70-90 | Plants | 3 ft. | 1½ ft. | | 6-8 plants | Semi-Hardy |
| Chard, Swiss | Feb. 15 to March 10 | 10 | 40-60 | Seed | 1½ ft. | 3 in. | ½ in. | ½ oz. | Semi-Tender |
| Kohlrabi | Feb. 15 to March 10 | 10 | 50-70 | Seed | 2 ft. | 6 in. | ½ in. | ¼ oz. | Hardy |
| Lettuce, Head | Feb. 15 to March 10 | 20 | 60-90 | Seed or Plant | 1-1½ ft. | 1 ft. | ¼ in. | ¼ oz. or 20 plants | Semi-Hardy |
| Lettuce, Leaf | Feb. 15 to March 10 | 20 | 40-70 | Seed or Plant | 1-1½ ft. | 3 in. | ¼ in. | ¼ oz. or 40 plants | Semi-Hardy |
| Onion | Feb. 15 to March 10 | 25 | 80-120 | Sets | 1-1½ ft. | 4 in. | 1 in. | ½ qt. sets | Hardy |
| Onion | Feb. 15 to March 10 | 25 | 90-120 | Plants | 1-1½ ft. | 4 in. | 1 in. | ½ oz. or 75 plants | Hardy |
| Peas, green | Feb. 15 to March 10 | 30 | 60-80 | Seed | 3 ft. | 2 in. | 2 in. | ½ lb. | Hardy |
| Potato, Irish | Feb. 15 to March 10 | 50 | 90-120 | Tuber pieces 2-3 oz. | 3 ft. | 1 ft. | 4 in. | 6-8 lbs. | Semi-Hardy |
| Radish | March 1 to April 15 | 15 | 20-40 | Seed | 1 ft. | 2 in. | ½ in. | ½ oz. | Hardy |
| Rhubarb | Fall or Spring | 12 | — | Crowns | 4 ft. | 2 ft. | 3 in. | 3-4 crowns | Hardy |
| Spinach | Feb. 15 to March 10 | 30 | 50-70 | Seed | 1½ ft. | 2 in. | ½ in. | ½ oz. | Hardy |
| Turnip | Feb. 15 to March 10 | 20 | 60-80 | Seed | 1½ ft. | 3 in. | ½ in. | ½ oz. | Hardy |

* [illegible]

| Vegetable | Time To Plant** | Feet of Row Per Person | Days to Harvest | Method of Planting | Spacing Between Rows | Spacing Within Rows | Depth to cover Seed | Quantity Needed Per Person | Frost Tolerance |
|---|---|---|---|---|---|---|---|---|---|
| **Warm Season** | | | | | | | | | |
| Bean, Lima | April 15-30 | 20 | 90-120 | Seed | 2-3 ft | 6 in | 1 in | ⅛ lb | Tender |
| Beans, Green or Wax | April 10-30 | 40 | 50-60 | Seed | 1½ ft | 4 in | 1 in | ⅛ lb | Tender |
| Beans, Pole | April 10-30 | 20 | 60-90 | Seed | 3 ft | 8-12 in | 1 in | ⅛ lb | Tender |
| Cantaloupe | May 1-20 | 20 | 80-100 | Seed or Plants | 3-5 ft | 2-3 ft | ½ in | ⅛ oz | Very Tender |
| Cucumber | April 10-30 or later | 5-10 | 50-70 | Seed or Plants | 3-5 ft | 2-3 ft | ½ in | ⅛ oz | Very Tender |
| Eggplant | April 10-30 | 5-10 | 80-90 | Plants | 3 ft | 1½ ft | | 3-5 plants | Very Tender |
| Okra | April 10-30 or later | 20 | 60-70 | Seed | 2-3 ft | 1½ ft | 1 in | ¼ oz | Tender |
| Pepper | April 10-30 or later | 10 | 80-110 | Plants | 3 ft | 2 ft | | 5 plants | Tender |
| Pumpkin | April 10-30 or later | 30 | 90-120 | Seed | 5 ft | 3-4 ft | 1 in | ⅛ oz | Tender |
| Southern Pea | May 1- June 10 | 20 | 85-100 | Seed | 3 ft | 4 in | 1 in | ⅛ lb | Tender |
| Squash, Summer | April 10-30 or later | 10-20 | 40-60 | Seed or Plants | 4 ft | 3 ft | 1 in | ⅛ oz | Very Tender |
| Squash, Winter | May 15-June 15 | 30 | 110-125 | Seed or Plants | 5 ft | 4 ft | 1 in | ⅛ oz | Very Tender |
| Sweet Corn | Mar. 15-April 15 | 50 | 80-100 | Seed | 3 ft | 1-1½ ft | 1 in | ⅛ lb | Tender |
| Sweet Potato | May 1- June 10 | 25 | 100-120 | Plants | 3 ft | 1 ft | | 25 plants | Very Tender |
| Tomato | April 10-30 | 10-20 | 70-80 | Plants | 4 ft | 2-3 ft | | 4-5 plants | Tender |
| Watermelon | May 1-20 | 10-20 | 80-120 | Seed | 5-8 ft | 5-6 ft | 1 in | ⅛ oz | Very Tender |

** These dates indicate planting times from southeast to northwest Oklahoma. Specific climate and weather may influence planting dates. For Warm Season vegetables, the soil temperature at the depth where the seeds are planted should be at least 50 F.

## Other Gardening Publications

OSU Extension Fact Sheets:

No. 1511 - "Trickle Irrigation for Lawns, Gardens, and Small Orchards"
No. 6005 - "Mulching Vegetable Garden Soils"
No. 6007 - "Improving Garden Soil Fertility"
No. 6009 - "Fall Gardening"
No. 6012 - "Growing Tomatoes in the Home Garden"
No. 6013 - "Summer Care of the Home Vegetable Garden"
No. 6015 - "Weed Control in the Home Garden"
No. 6032 - "Vegetable Varieties for Oklahoma"
No. 7313 - "Home Garden Insect Control"
No. 7314 - "Control of Diseases and Nematodes in the Home Garden"
No. 7618 - "Soil Fumigation and Treatment to Control Soil Borne Diseases and Nematodes in Home Gardens"
No. 7625 - "Common Diseases of Tomatoes Part I. Diseases Caused by Fungi."
No. 7626 - "Common Diseases of Tomatoes Part II. Diseases Caused by Bacteria, Viruses, and Nematodes."
No. 7627 - "Common Diseases of Tomatoes Part III. Diseases Not Caused by Pathogens."
No. 7635 - "Diseases of Cucurbits (Watermelons, Cucumbers, Cantaloupes, Squash and Pumpkins)"
No. 7640 - "Solar Heating (Solarization) of Soil in Garden Plots for Control of Soil-Borne Plant Diseases"
No. 7646 - "Diseases of Asparagus in Oklahoma"

This Fact Sheet is based on original material prepared by R.E. Campbell.

# Common Garden Problems

| Symptoms | Possible Causes | Corrective Measures |
|---|---|---|
| Plants stunted in growth; yellow colored foliage | Lack of soil fertility or soil pH abnormal | Use fertilizer and correct pH according to soil test. Use 2 to 3 pounds of complete fertilizer per 100 square feet in absence of soil test. |
| | Plants growing in compacted, poorly-drained soil | Modify soil with organic matter, coarse sand. Provide surface drainage. |
| | Insect or disease damage. Root Knot Nematode | Use recommended control treatments. |
| | Iron deficiency | Apply iron to soil or foliage. Correct soil pH |
| Plants stunted in growth, purplish colored leaf veins. | Low temperature | Plant at proper time. Don't use light-colored mulch too early in the season. |
| | Inadequate phosphate | Apply phosphorus at soil test recommendation. |
| Holes in leaves, leaves yellowish and drooping, or distorted in shape. | Damage by insects | Use recommended insecticide treatment. |
| Plant leaves with spots, dead, dried areas, or powdery or rusty areas. | Plant disease | Use resistant varieties, remove diseased plants when noticed and use recommended control treatments. |
| Plants wilt even though sufficient water is present. | Soluble salts too high or root system damage | Have soil tested. Use recommended treatments of insecticides and fungicides. |
| | Poor drainage and aeration | Add organic matter, gypsum or sand; ridge soil for surface drainage. |
| | Insect or nematode damages | Use recommended varieties and soil insecticides or nematicides. |
| Plants tall, spindly and unproductive | Excessive shade | Relocate to sunny area. Keep down weeds. |
| | Excessive nitrogen | Reduce applications of nitrogen. |
| Blossom drop (tomatoes) | Hot winds, dry soil | Use mulch and water. Plant heat tolerant varieties. |
| | Low night temperatures | Avoid early planting. |
| | Overwatering or disease | Reduce watering, use recommended disease control treatments. |
| Tomato leaf roll | Excess nitrogen and water | Withhold nitrogen, reduce watering. |
| | Curly top disease of beets | Remove plant if diseased. |
| Leathery, dry, brown blemish on the blossom end of tomatoes, peppers and watermelons. | Blossom end rot | Maintain uniform soil moisture and apply mulch. Avoid overwatering and excessive nitrogen. Select resistant varieties. |

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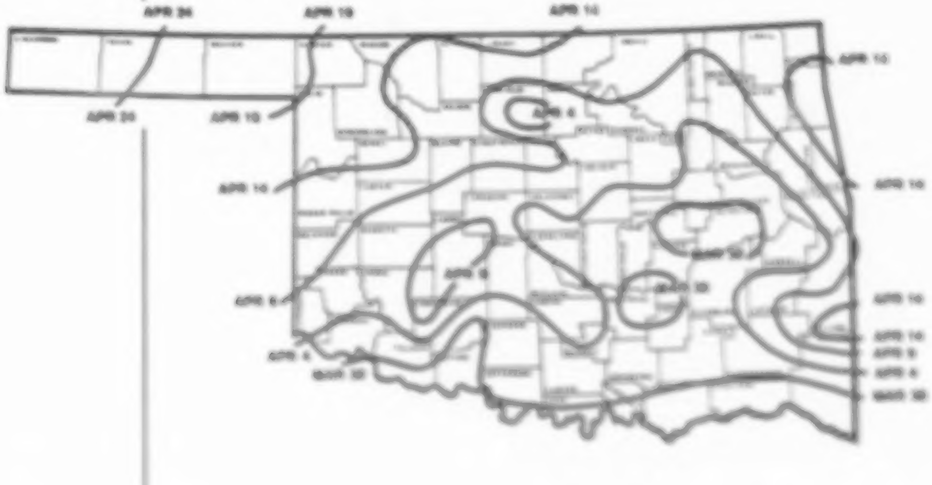
Courtesy of Oklahoma State University Cooperative Extension Service

## Freezing Temperatures in Oklahoma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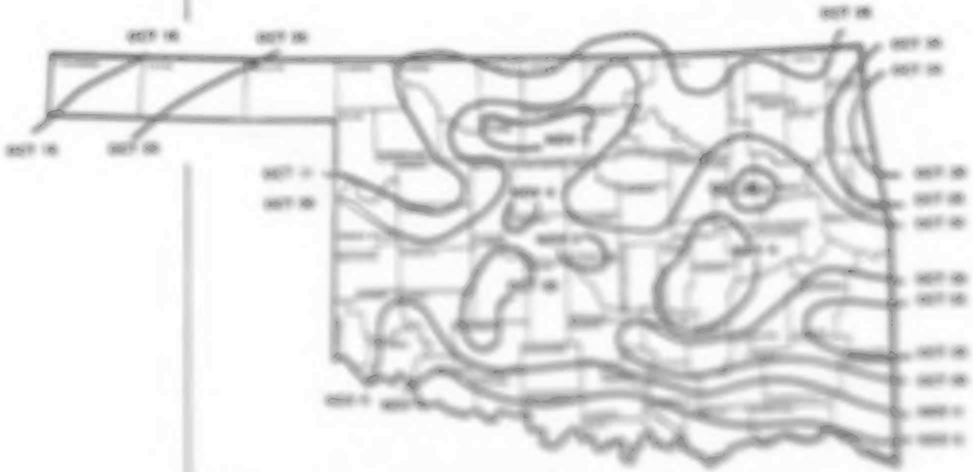
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Courtesy of Oklahoma State University Cooperative Extension Service

**Table 5. Approximate Composition of Some Common Organic Materials.**

| Material | % Moisture | N |  | $P_2O_5$ |  | $K_2O$ |  |
|---|---|---|---|---|---|---|---|
|  |  | % | lbs/ton | % | lbs/ton | % | lbs/ton |
| Bone Meal, raw | 0 | 3.0 | 60 | 22.0 | 440 | — | — |
| Cottonseed Meal | 0 | 6.0 | 120 | 3.0 | 60 | 1.5 | 30 |
| Peanut Meal | 0 | 7.0 | 140 | 1.5 | 30 | 1.2 | 24 |
| Soybean Meal | 0 | 7.0 | 140 | 1.2 | 24 | 1.5 | 30 |
| Feedlot Manure, beef | 68 | 0.7 | 14 | 0.64 | 12.8 | 0.89 | 17.8 |
| Poultry Manure (no litter) | 54 | 1.6 | 31 | 0.92 | 18.4 | 0.42 | 8.4 |
| Alfalfa Hay | 10 | 2.5 | 50 | 0.50 | 11 | 2.5 | 50 |
| Oat Straw | 10 | 0.65 | 13 | 0.20 | 5 | 0.02 | 40 |
| Wheat Straw | 8 | 0.60 | 12 | 0.15 | 3 | 0.95 | 19 |
| Cotton Gin trash | 0 | 0.70 | 14 | 0.18 | 3.6 | 1.2 | 24 |

Source: Knott's Handbook for Vegetable Growers and Western Fertilizer Handbook

Courtesy of Oklahoma State University Cooperative Extension Service

**ASSIGNMENT SHEET 1**

# INTRODUCTION TO VEGETABLES AND SMALL FRUITS

**XX**

NAME ______________________________ SCORE ______

**OBJECTIVE 11**

**Look up information in Oklahoma State University Extension fact sheets.**

**INTRODUCTION**

Oklahoma State (University) Cooperative Extension Service prints a wide range of fact sheets which are helpful to both the home gardener and the large commercial grower. These fact sheets contain information especially important for plant survival in Oklahoma soils and weather. Your success may well depend on your ability to understand and use these publications.

**DIRECTIONS**

Look through Supplements 1 through 4. Supplement 1, *Fact Sheet Index*, provides a list of fact sheets available and their corresponding titles. Included also is a sample Fact Sheet.

Look at Supplement 1. Find the *OKLAHOMA GARDEN PLANNING GUIDE* in the index.

1. Write the number of the fact sheet here.____________

   Look at Supplement 2. Answer the following questions.

2. How often should you have garden soil tested?

   ________________________________________

3. Where can you store seeds remaining after planting?

   ________________________________________

NAME ______________________________ SCORE _______

**OBJECTIVE 12** **Plan a small vegetable garden.**

**INTRODUCTION** It is important that you be able to use the available information in planning a garden and making the best plant choices. This assignment sheet will give you the opportunity to use the fact sheet and what you have already learned in planning a garden that will have the greatest productivity.

**DIRECTIONS** On the back of this sheet, draw a garden plot that is 10 feet by 20 feet. Use a scale of 1/2 inch = 1 foot. Make the long dimension and the rows run east and west. Select any 6 vegetables from the list in Supplement 2. (*OKLAHOMA GARDEN PLANNING GUIDE*, 6004). Fill in the chart below. Mark on the garden plot where you would plant each vegetable. Be sure to place the tall plants so they don't block the sun from smaller plants.

GARDEN PLANNING CHART

| Vegetable Variety | Feet of Row Required | Planting Date | Seasonal Maturity | Comments |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |
| 7. | | | | |
| 8. | | | | |
| 9. | | | | |
| 10. | | | | |

1252

NAME ______________________________ SCORE ______

**OBJECTIVE 13** **Plan a fruit garden.**

**INTRODUCTION**

Fruit plots have special needs because of the pH values and preferred soil types. This assignment asks you to think about how to plan for a fruit plot or garden and the adjustments you would have to consider.

Here are pH requirements for small fruits:

| | |
|---|---|
| Blackberries | 4.5-5.5 |
| Grapes | 5.5-6.5 |
| Raspberries | 5.0-6.0 |
| Strawberries | 5.0-6.5 |
| Blueberries | 4.0-5.5 |

If soil pH is not in this range, it must be adjusted. Usually this means lowering the pH by adding aluminum sulfate.

**DIRECTIONS**

On the following page, draw a fruit plot 100 ft. x 100 ft. Use a scale of 1/2 inch = 1 foot. Select any 2 fruits using the information from Supplement 2 (*OKLAHOMA GARDEN PLANNING GUIDE*, 6004) and Objectives 9 and 10. Refer to Supplement 2 and Objectives 9 and 10 to select fruits. Then answer the questions below.

1. Select four fruits to grow in your garden. List them below.

______________________________________

______________________________________

______________________________________

______________________________________

______________________________________

______________________________________

2. You have a 100 ft. x 100 ft. garden space in which to grow your fruits. What is the total area of the plot in square feet?

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

_______________________________________________

3. Your soil has a pH of 7. Determine the minimum amount of aluminum sulfate needed for each type of fruit if each crop uses 1/4 of the plot. Add aluminum sulfate at the rate of .1 lb. per square foot to lower the pH by .5.

   a. What is the square footage assigned to each type of fruit?

   _______________________________________________

   b. Determine how much you will have to adjust the pH level for each type of fruit you will grow. (Use the highest pH number for each fruit). Also, determine how much aluminum sulfate needs to be added.

   **Fruit 1** ____________________

   pH must be lowered__________points

   How much aluminum sulfate?________

   **Fruit 2** ____________________

   pH must be lowered__________points

   How much aluminum sulfate?________

   **Fruit 3** ____________________

   pH must be lowered__________points

   How much aluminum sulfate?________

   **Fruit 4** ____________________

   pH must be lowered__________points

   How much aluminum sulfate?________

## ASSIGNMENT ANSWERS

## INTRODUCTION TO VEGETABLES AND SMALL FRUITS

## XX

### ASSIGNMENT SHEET 1

1. 6004.
2. Test soil every three to four years.
3. Seeds remaining after planting may be stored in a refrigerator or food freezer.

### ASSIGNMENT SHEET 2

Answers will vary according to vegetables selected. Note whether students place taller plants so that they do not block the sun from shorter plants.

### ASSIGNMENT SHEET 3

Answers will vary according to fruits selected. For this assignment the student should make a change in the pH level of the soil.

1. Check that four fruits are listed.
2. 10,000 square feet
3. a. 2,500 square feet
   b. Check student's math for the amount of aluminum sulfate added to change soil pH. Answers should include:

      Blackberries: 1.5 change in pH; 375 lbs.

      Grapes: .5 change in pH; 125 lbs.

      Strawberries: .5 change in pH; 125 lbs.

      Raspberries: 1.0 change in pH; 250 lbs.

      Blueberries: 1.5 change in pH; 375 lbs.

## Horticulture

| | | |
|---|---|---|
| 6000 | Fertilizing Commercial Vegetables Crops | 6-87 |
| 6004 | Oklahoma Garden Planning Guide | 1-87 |
| 6005 | Mulching Garden Soils | Rev 5-88 |
| 6007 | Improving Garden Soil Fertility | 2-84 |
| 6008 | Weed Control in Vegetables | Rev 1-88 |
| 6009 | Fall Gardening | 2-84 |
| 6012 | Growing Tomatoes in the Home Garden | Rev 2-88 |
| 6013 | Summer Care of the Home Vegetable Garden | 2-84 |
| 6014* | Making a Compost Pile | 2-84 |
| 6015 | Weed Control in the Home Garden | 2-84 |
| 6016* | Asparagus Culture in the Home Garden | 4-81 |
| 6018 | Asparagus | AF 1-85 |
| 6019 | Commercial Production of Fresh Market Tomatoes | 2-87 |
| 6020 | Growing Vegetable Transplants | 2-84 |
| 6021 | Sweet Corn Production | AF 10-82 |
| 6022* | Sweet Potato Production | AF 1-85 |
| 6023 | Slicing Cucumber Production | AF 12-82 |
| 6024 | Snap Bean Production | AF 11-82 |
| 6025 | Okra Production | AF 12-82 |
| 6026 | Squash and Pumpkin Production | AF 2-83 |
| 6027* | Production of Cabbage, Cauliflower, Broccoli & Brussel Sprouts | AF 2-8[illegible] |
| 6028 | Potato production | 6-87 |
| 6029 | Southern Pea Production | 5-87 |
| 6030 | Pepper Production | Rev AF 9-85 |
| 6031* | Greens Production (Spinach, Turnip, Mustard and Collard) | AF 7-83 |
| 6032 | Vegetable Varieties for Oklahoma | 2-86 |
| 6200 | A Calendar for Pecan Growers | 12-82 |
| 6201 | Pecan Varieties for Oklahoma | 8-85 |
| 6204 | Bark Grafting Pecans | 2-84 |
| 6205 | Splice and Tongue Grafting Pecans | 12-82 |
| 6206 | Patch Budding Pecans | 7-78 |
| 6207 | Starting Pecan Trees | 3-87 |
| 6208* | Improving Native Pecan Groves | 2-84 |
| 6209 | Pecan Insect and Disease Control 1988 | Rev CR 4-88 |
| 6210 | Recommended Apple and Peach Varieties | 5-85 |
| 6211 | Propagation of Fruit and Nuts by Seed | 12-78 |
| 6214 | Growing Strawberries in the Home Garden | 4-84 |
| 6216 | Soils for Fruit Trees | 2-84 |
| 6217 | Collecting and Storing Pecan Propagation Wood | 2-84 |
| 6218 | Peanuts in the Home Garden | Rev 1-88 |
| 6221 | Grape, Blackberry and Strawberry Insect and Disease Control - 1988 | Rev CR 4-88 |
| 6222* | Home Fruit Planting Guide | 2-84 |
| 6227 | Propagating Peaches by "T" Budding | 12-82 |
| 6228 | Annual Pruning of Fruit Trees | Rev 3-88 |
| 6229 | Pollination Requirements for Fruits and Nuts | 3-77 |
| 6230 | Four-Flap Grafting of Pecans | 2-84 |
| 6232 | Fertilizing Pecan and Fruit Trees | 2-84 |
| 6235* | Home Fruit Spray Schedules | 4-87 |
| 6236 | Watermelon Production | AF 6-83 |
| 6237 | Cantaloupe Production | AF 1-83 |
| 6238* | Strawberry Production in Oklahoma | AF 4-85 |
| 6239 | Commercial Blackberry Production in Oklahoma | AF 2-83 |
| 6240 | Commercial Peach and Nectarine Insect and Disease Control - 1988 | Rev CR 4-88 |
| 6241 | Commercial Apple Insect and Disease Control - 1988 | Rev CR 4-88 |
| 6242 | Weed Control in Pecans, Apples and Peaches | CR 8-86 |
| 6243 | Weed Control in Small Fruit Crops | 2-87 |
| 6400* | Roses in the Landscape | 10-84 |
| 6403 | Rose Culture in Oklahoma | 10-84 |
| 6404 | Winter Protection for Landscape Planting | Rev 10-86 |
| 6407* | Flower Arrangements | 2-84 |
| 6408 | Landscape Maintenance Schedule | Rev 12-86 |
| 6409 | Pruning Ornamental Trees and Shrubs | 7-85 |
| 6411 | House Plant Care | 2-84 |
| 6412 | Fertilizing Shade and Ornamental Trees and Shrubs | 12-85 |
| 6413 | Poinsettias | AF 12-80 |
| 6414 | Planting Shade Trees and Shrubs | 1-87 |
| 6415 | Training Young Shade and Ornamental Trees | AF 9-85 |
| 6416 | Shade & Ornamental Tree Appraisal | Rev AF 4-88 |
| 6417* | Landscaping for Energy Conservation | AF 9-85 |
| 6418* | Selecting a Lawn Grass for Oklahoma | 5-85 |
| 6419* | Establishing a Lawn in Oklahoma | 9-85 |
| 6420* | Lawn Management in Oklahoma | 9-85 |
| 6421* | Controlling Weeds in Home Lawns | 9-85 |
| 6422 | 1985 Partial Listing of Herbicides, Registered in OK for Use on Turf | CR 8-85 |
| 6423* | Controlling Grassy Weeds in Home Lawns | 9-85 |
| 6600 | Turfgrass Management of Bermudagrass Football Fields | 7-87 |

## Insects

| | | |
|---|---|---|
| 7000 | Beef Cattle Parasite Controls | 8-82 |
| 7001 | Common Ticks of Oklahoma | Rev 2-87 |
| 7004 | External Poultry Parasite Controls | 3-83 |
| 7005 | Sheep and Goat Insect Pest Control | Rev 7-87 |
| 7006 | Summer Ticks on Beef Cattle | 1-80 |
| 7007 | Biology and Control of the Face Fly | 3-84 |
| 7008 | Human Lice and Scabies | 2-80 |
| 7009* | Biology and Control of Cattle Lice | 2-83 |
| 7010 | Ticks and Fleas in Homes, Lawns and on Pets | Rev 5-88 |
| 7012 | Mosquito Control | Rev 5-88 |
| 7013 | Rodents and Their Control in and Around Dwellings | 11-85 |
| 7014 | Horse External Parasite Control Suggestions | CR 11-88 |
| 7015 | Horse External Parasite Control Series Part 1 | 11-88 |
| 7016 | Horse External Parasite Control Series Part II | 11-88 |
| 7150 | Alfalfa Forage Insect Control | 7-84 |
| 7151* | Strip Cropping Cotton and Sorghum for Bollworm Control | CR 3-73 |
| 7153* | Identifying Oklahoma Cotton Pests | 3-66 |
| 7154* | Worm Pests of Oklahoma Cotton | 3-66 |
| 7155 | Nectar and Pollen Plants of Oklahoma | 3-74 |
| 7156 | Field Key to Larvae in Soybeans | 2-74 |
| 7157 | Field Key to Larvae in Sorghums | 5-79 |
| 7158 | Field Key to Larvae in Peanuts | 2-74 |
| 7159 | Field Key to Larvae in Alfalfa | 2-74 |
| 7160 | Field Key to Larvae in Corn | 7-79 |
| 7161 | Field Key to Larvae in Cotton | 2-74 |
| 7162 | Cotton Insect Control - 1984 | 3-84 |
| 7163 | Field Key to Larvae on Pecans | Rev 11-85 |
| 7164 | Field Key to Beetles in Pines | 8-81 |
| 7165* | Nematode Control in Peanuts | CR 5-71 |
| 7167 | Soybean Insect Survey and Control in Oklahoma | 3-84 |
| 7168 | Plant Galls Caused by Insects | 3-84 |
| 7169* | Potato Disease Prevention and Control | 5-79 |
| 7170 | Control of Sorghum Insects | Rev 7-85 |
| 7171 | Sequential Sampling of the Cotton Fleahopper in Oklahoma | CR 7-79 |
| 7172* | Sequential Sampling of the Boll Weevil in Oklahoma | CR 12-80 |
| 7174 | Peanut Insect Control in Oklahoma (Pest Management Series) | 4-84 |
| 7175* | Sampling Methods for Adult Pecan Weevils | 3-80 |
| 7176 | Insects on Small Grains and Their Control | Rev 3-87 |
| 7177 | Sampling for the Alfalfa Weevil in Oklahoma (Pest Mgmt. Series) | Rev CR 12-85 |
| 7178* | Oklahoma Peanut Disease Loss Estimates for 1979 | CR 2-80 |
| 7179 | Integrated Control of the Alfalfa Weevil | CR 10-82 |
| 7180 | Stored Grain Insect Control in Oklahoma | Rev 3-87 |
| 7181 | Sequential Sampling for Predators in Cotton | CR 6-83 |
| 7182 | OK Cone Trap Procedure for Timing In- Insecticide Applications for Pecan Weevil | 2-84 |

Courtesy of Oklahoma State University Cooperative Extension Service

WRITTEN TEST

# INTRODUCTION TO VEGETABLES AND SMALL FRUITS

# XX

NAME ______________________________ SCORE _______

**OBJECTIVE 1**

**Match small fruits and vegetables to their proper classifications based on the part of the plant that consumers use.** Write the correct letter in the blank preceding each plant. Some plants may fit into more than one classification.

___ 1. Watermelon

___ 2. Strawberries

___ 3. Beans

___ 4. Cabbage

___ 5. Cauliflower

___ 6. Tomatoes

___ 7. Peppers

___ 8. Cantaloupe

___ 9. Potatoes

___ 10. Onions

___ 11. Beets

___ 12. Leeks

___ 13. Broccoli

___ 14. Celery

___ 15. Asparagus

a. Grown for their stems and leaves

b. Grown for their fleshy storage organs

c. Grown for their seeds and fruits

**OBJECTIVE 2** **Match plant types to proper classifications based on their hardiness (freezing temperature tolerance).** Write the correct letter in the blank. (Answers will be used more than once.)

____1. beet, carrot, cauliflower, lettuce, herbs, potato, salsify, celery

____2. cowpea, snap bean, soy bean, sweet corn, tomato

____3. chard, chicory, Chinese cabbage, endive

____4. pumpkin, winter squash, sweet potato, watermelon

____5. kohlrabi, leek, mustard, parsley, peas, radish, rhubarb

____6. summer squash, New Zealand spinach

____7. cucumber, eggplant, lima beans, mushmelon, okra, hot pepper, sweet pepper

____8. turnip, cabbage, chives, collards, garlic, onion, spinach

____9. horseradish, kale, asparagus, broccoli

a. Frost tolerant

b. Tender

c. Very Hardy

d. Warm loving

**OBJECTIVE 3** **Describe physical factors and requirements for vegetable and small-fruit production.**

1. Soil preparation—

____________________________________________

____________________________________________

2. Pest control—

____________________________________________

____________________________________________

____________________________________________

3. **Sunlight—**

________________________________________

________________________________________

________________________________________

4. **Plant hardiness—**

________________________________________

________________________________________

________________________________________

5. **Water—**

________________________________________

________________________________________

________________________________________

6. **Fertilizers—**

________________________________________

________________________________________

________________________________________

7. **Weed control—**

________________________________________

________________________________________

**OBJECTIVE 4**

**Match types of growing structures to their correct descriptions.** Write the correct letters in the blanks.

____1. Plastic-covered rows of plants growing in the ground

____2. Used primarily to start early plant growth in the spring; functions as a miniature greenhouse and is heated by the sun and an underground heat source

____3. Similar to the hot bed but is used as a temporary place for plants being transferred from a greenhouse to the outdoors

____4. Glass or plastic-covered houses for starting or growing plants

____5. Small plastic covers used to keep small plants warm in the spring or fall

____6. Sheets of lightweight material that are placed over vegetables to provide insulation

____7. Plastic covers for individual plants; side pockets hold water which retain heat for cool nights

a. Cooler

b. Greenhouse

c. Cold frame

d. Hotframe

e. Hotbed

f. Reefer

g. Water caps

h. Coldcaps

i. Tunnels

j. Floating-row covers

k. Quonset

l. Hot caps

**OBJECTIVE 5**

**Select true statements concerning goals of soil preparation.** Write "T" in front of true statements and "F" in front of false statements.

____1. Fertilization—Provides non-vital elements needed for plant growth; decomposition and rate of application depends on locality, soil, crops, and timing of application.

____2. Aeration—Allows air to dry out the roots and hasten ripening of fruit.

____3. Breaking up clods—Allows better mix of humus, water, and air in the soil; helps prevent weed growth.

____4. Incorporate non-organic matter—Releases calcium, minerals, and other vitamins for plant use; also aids in retention of water.

___ 5. Incorporating organic matter—Releases nitrogen, minerals, and other nutrients for plant use; also aids in retention of water.

___ 6. Aeration—Allows air to dry out the roots and prevent rotting.

___ 7. Clodding—Creates adequate rootballs vital to plant growth.

___ 8. Fertilization—Provides vital elements needed for plant growth; composition and rate of application depends on locality, soil, crops, and timing of application.

**OBJECTIVE 6**

**Match methods of soil cultivation to their correct descriptions.** Write the correct letters in the blanks.

___ 1. Breaks up clods and levels soil

___ 2. Turns soil over, digging about 8 inches deep

___ 3. Used for small garden work only

a. Hammermill

b. Plow

c. Dozer

d. Harrow

e. Disk Harrow

f. Freewheeler

g. Hog harrow

h. Punch

i. Shovel

**OBJECTIVE 7**

**Distinguish between advantages of raised bed planting methods and advantages of flat bed planting methods.** Write "R" in front of the advantages of raised bed planting methods. Write "F" in front of the advantages of flat bed planting methods.

___ 1. Looser soil for root crops

___ 2. Seeds won't wash into hard soil

___ 3. Soil warms faster

___ 4. Plants are in production sooner

___ 5. Better drainage in wet soils

____6. Requires less labor

____7. Clay soil stays more workable

____8. Beds don't bake down

____9. Easy to irrigate

___10. Soil stays soft all year

___11. Better aeration

___12. No erosion problems

___13. More adaptable to block planting (broadcast planting)

**OBJECTIVE 8**

**Distinguish between advantages of direct seeding and advantages of transplanting.** Write a "D" in front of advantages of direct seeding and write a "T" in front of advantages of transplanting.

____1. Early weed control not necessary

____2. No expense in pots, flats, soil mix, watering systems, fertilizers, shelter

____3. Best for plants that do not transplant well (vine crops such as cucumbers, watermelons)

____4. Most economical for most root crops except sweet potatoes

____5. Uniform plant spacing

____6. No thinning required

____7. Lower cost

____8. Requires less labor

____9. Seeding operation is faster

___10. Bigger plants earlier

___11. Best for plants that are hard to germinate in soil.

___12. Higher germination rate

___13. No labor in filling flats, mixing potting medium, seeding, watering, and transplanting

**OBJECTIVE 9** **List small fruits common to Oklahoma.**

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**OBJECTIVE 10** **State similarities and differences in small-fruit cultures.**

Cultures preferred by all fruits

________________________________________

________________________________________

________________________________________

Cultures preferred by specific fruits

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**NOTICE** The following assignment sheets are not a part of the written test. If these items have not been completed check with your instructor.

**OBJECTIVE 11** **Look up information in Oklahoma State University Extension fact sheets.** SCORE ______

**OBJECTIVE 12** **Plan a small vegetable garden.** SCORE ______

**OBJECTIVE 13** **Plan a small fruit garden.** SCORE ______

**WRITTEN TEST ANSWERS**

# INTRODUCTION TO VEGETABLES AND SMALL FRUITS

# XX

**OBJECTIVE 1**

1. c
2. c
3. c
4. a
5. a
6. b
7. c
8. c
9. b
10. a & b
11. b
12. a & b
13. a
14. a
15. a

**OBJECTIVE 2**

1. a
2. b
3. a
4. d
5. c
6. b
7. d
8. c
9. c

**OBJECTIVE 3**

1. Soil preparation—Includes proper cultivation and addition of organic matter which helps hold water, reduces compaction, and allows aeration. Maintains soil fertility and controls plant pests.

2. Pest control—Includes control of insects, fungi, bacteria, viruses, and nematodes.

3. Sunlight—Smaller plants should not be blocked by larger vegetables, shrubs, or trees. In gardens with east-west rows, plants should be planted to the northern-most end of a garden.

4. Plant hardiness—Plants are divided in to hardiness classifications based upon their ability to survive a frost; warm-loving plants should not be planted too early in spring or cool-loving plants too late into summer.

5. Water—Proper amount and timing of water is important; only water held in suspension in the soil is useful to the root system.

6. Fertilizers—Plant production and quality depends on correct amounts, proper balance, and timing of application.

7. Weed control—Removing weeds by physical or chemical means reduces competition for nutrients, moisture, and light.

**OBJECTIVE 4**

1. i
2. e
3. c
4. b
5. l
6. i
7. g

**OBJECTIVE 5**

1. F
2. F
3. T
4. F
5. T
6. T
7. F
8. T

**OBJECTIVE 6**

1. d, e
2. b
3. e
4. i

**OBJECTIVE 7**

1. R
2. R
3. R
4. R
5. R
6. F
7. R
8. R
9. R
10. R
11. R
12. R
13. F

**OBJECTIVE 8**

1. T
2. D
3. D
4. D
5. T
6. T
7. D
8. D
9. D
10. T
11. T
12. T
13. D

**OBJECTIVE 9**

Answers may be in any order.

- Strawberries
- Blueberries
- Blackberries
- Raspberries
- Grapes

**OBJECTIVE 10**

Cultures preferred by all fruits

- Full sun
- Well-drained, slightly acidic soil
- Added organic matter

Cultures preferred by specific fruits

- Strawberries—Prefers rich, sandy loam
- Blueberries—None
- Blackberries—Needs soil that retains large amounts of water; do not like sandy soils
- Raspberries—Can tolerate cold temperatures but dislike wide fluctuations in temperature
- Grapes—Prefer sandy loam

**OBJECTIVE 11** Refer to answers to Assignment Sheet 1.

**OBJECTIVE 12** Refer to answers to Assignment Sheet 2.

**OBJECTIVE 13** Refer to answers to Assignment Sheet 3.

**OBJECTIVE SHEET**

# INTRODUCTION TO GARDEN FLOWERS

## XXI

**INTRODUCTION**

Garden flowers and borders add color and beauty to lawns, homes, businesses, and open areas. The quality of our lives is enriched outdoors by splashes of color and pattern, and indoors by fragrances, bouquets, floral arrangements, hanging baskets and potted plants. You will learn the beginning steps in how to create flower beds and borders and to blend and contrast colors. You will learn the characteristics of garden flowers and plants and will be able to recognize and use a variety of flowers that grow well in the Southwest.

**UNIT OBJECTIVE**

After completing this unit, the student should demonstrate knowledge of garden flower varieties, their uses, requirements, characteristics, and methods of propagation. The student should use that knowledge to plan a flower bed or border. The students will demonstrate their competencies by completing assignment sheets, job sheets, practical tests, and a written test with a minimum of 85 percent accuracy.

**SPECIFIC OBJECTIVES**

After completing this unit, the student should be able to

1. Match terms associated with garden flowers to their correct definitions.
2. Match plant structures to their correct names.
3. Match perennials with their correct propagation methods.
4. Describe uses of garden flowers.
5. Select from a list considerations for planting a flower bed or border.
6 State general soil type and pH range for garden soils.
7. Describe light exposure requirements and characteristics of ten species of annuals.
8. Describe light exposure requirements and characteristics of two species of biennials.
9. Describe light exposure requirements and characteristics of ten species of flowering perennials.

10. Describe light exposure requirements and characteristics of five species of ground cover and vines.

11. Describe light exposure, soil, and moisture requirements for three species of bulbs.

12. Select compatible varieties of flowers to be planted in full sun and partial shade. (Assignment Sheet 1)

13. Plan a garden or border using varieties of annuals, biennials, and perennials. (Assignment Sheet 2)

14. Demonstrate the ability to
    a. Prepare a soil bed. (Job Sheet 1)
    b. Grow flowering annuals from seed. (Job Sheet 2)
    c. Care for plants after planting. (Job Sheet 3)

## PREPARATION

- Study the specific objectives to determine those you will cover in your presentation. Decide also which objectives should be taught to which students.

- Determine scope and sequence of objectives that you add. Design and develop support materials, including evaluation techniques, for additional objectives.

- Review teaching suggestions and plan classroom activities.

- Determine how you will schedule time for students to demonstrate competency in the required procedures.

  NOTE: Schedule carefully. The job sheets cover the period from fall to spring, and/or from winter to and possibly through the growing season: garden soil preparation in the fall, seeding flats 6-8 weeks before the frost-free date in your area, setting out bedding plants, and caring for growing plants.

- Order materials to supplement unit.

  Seeds—If this unit is taught during the growing season, encourage students to plant and care for a flower garden or border.

- Obtain bulbs, corms, tubers, tubular roots, and rhizomes for students to identify and to demonstrate separation and division.

- Gather resources that show flower colors, such as seed catalogs, slide presentations, horticulture and gardening magazines, and photographs. Look for examples of garden beds, borders, ground covers, hanging baskets, mass plantings, potted plants, and edging. Keep in mind that the unit is organized into annuals, biennials, perennials, ground covers, vines, and bulbs.

- Have a pH chart available for students to use, if desired.

- In season, arrange a field trip for students to see floriculture operations, home and commercial flower gardens, and borders.

- Invite a landscape architect or a successful home gardener to discuss design and planting with the class.

**NOTE:** Physical plant managers or grounds managers at major public institutions, such as universities or government offices, are an excellent resource. Supply guest speakers with the Objective Sheet, Information Sheet, and any other components you want them to cover.

- Invite a florist to demonstrate and discuss using garden flowers in bouquets, floral arrangements, and hanging baskets.

**NOTE:** Supply guest speakers with the Objective Sheet, Information Sheet, and any other components you want them to cover.

## DELIVERY

**Objectives 1 and 2**

- Review terms and definitions with students.
- Have students name various plant structures located in the classroom.

**Objectives 3 through 6**

- Show examples of non-seed perennials and demonstrate propagation techniques.
- Invite a landscape architect, institutional grounds manager, and/or florist to discuss the uses of garden flowers and considerations for planting gardens and borders.
- If seasonal timing is appropriate, dig and divide or separate perennials.
- Show pictures or slides or take a field trip to a garden and discuss the design and floral selections.

**Objectives 7 through 11**

- Teach techniques for memorization to help students learn and memorize the uses and characteristics of thirty plants. (See Suggested Resources: *Develop Learning Techniques*.)
- If flowers are in bloom, take a field trip to see gardens, borders, and mass plantings.
- Provide color pictures and allow students time to study them in class.

- Have students complete Activity Sheet 1—"Make Your Own Planting Charts." Stress that making their own charts will help them narrow the number of items to learn and will help them remember.
- Stress that everyone in horticulture should know by heart at least ten annuals and perennials, two biennials, five ground covers and vines and three bulbs. This is a minimum requirement.
- Share with students your own experience in learning and memorizing plants and their characteristics.
- Discuss soil type, time of blooming, height, spacing, blending color, and color variety of plants best suited for your geographic area.

**APPLICATION**

- Use Assignment Sheet 1 to give students practice and experience in using planting charts and working with the variables for planning a garden or border.
- Use Assignment Sheet 2 to give students the experience of planning a garden or border in full sun and partial shade.
- If possible, carry a single group of students through the entire process of the job sheets. If maintaining continuity is not possible, allow the students present to continue the projects.
- Refer students to Unit 10 *Transplanting*.

**EVALUATION**

**Practical test**

- Explain to students that they will be asked to demonstrate procedures on the job sheets to complete the practical test.
- Describe the rating scale used on the practical test.
- Reteach and retest as necessary.

**Written Test**

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give written test.

  **NOTE:** The written test may be given in sections if desired.

- Evaluate students on assignment sheet activities if not previously done.

- Reteach and retest if necessary.

- Complete appropriate section of competency profiles.

- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

## SUGGESTED RESOURCES

**Audiovisual Materials**

- *How to Grow Flowers*. Color VHS 50 min. 1988, Burpee. Covers how to (1) grow, nurture, and transplant seedlings (2) plant perennials, annuals and bulbs, use mulch to minimize water loss, control weeds, avoid disease and compaction (4) water efficiently (5) fertilize (6) perform simple maintenance (7) protect flowers from insects and disease (8) cut and display flowers. Order No. V155.

- *How to Grow and Nurture Seedlings*. Color VHS, 49 min, 1988 Burpee. Shows how to garden more successfully with less effort; by using modern scientific methods and time-proven techniques. Order No. V156.

- *Plant Propagation Vol 1*. Color VHS, 20 min, 1987. Covers propagation by seed, specialized parts, division, micro-propagation. Order No. VT121.

  NOTE: These films are available to Oklahoma teachers on a free-loan basis. Oklahoma teachers may order these films from the Resource Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074; telephone, in Oklahoma call 1-800-522-5810, out of Oklahoma call 1-800-654-4502.

- *4 - H Horticulture Identification* Video Tape. Part 3, "Vines and Ground Covers" 5 min. 27 sec. Order no. VT100, available from OSU County Cooperative Extension Center or from Dean McGraw, Extension Vegetable and Youth Specialist, 340 Ag Hall, OSU, Stillwater, OK 74078.

- *Perennial and Annual Tour Show*. Color VHS, 28 min, 1987, OSU. A tour of a well-landscaped backyard, showing various annual and perennial flowers to bring summer color to the landscape. Order No. VT50, available from OSU Ag. Info. Library, Oklahoma State University, Stillwater, OK 74078.

- Computer program: *AgriQuiz, Floriculture*. Has 200 self-teaching questions on floriculture, including plant identification. IBM-compatible program, requires 640K memory. Available from Midwest Agribusiness Services, Inc., 6739 Glacier, West Bend, Wisconsin 54095-9360.

**Publications**

- *The Color Dictionary of Flowers and Plants for Home and Garden*. Roy Hay and Patrick M. Synge. Contains more than 2,000 color photos with notes on cultivation. Order No. 117, available from American Nurseryman, 111 N. Canal St., Suite 545, Chicago, IL 60606-7203, telephone 1-800-621-5727.
- *Vines for Landscaping*. Illustrated with photos, the pamphlet includes uses of vines, factors to consider when selecting vines, lighting of hardy vines, special categories of vines, a quick reference chart and index. Order No. VAS 5034, available from Vocational Agriculture Service, College of Agriculture, University of Illinois, 1401 S. Maryland Dr., Urbana, IL 61801.
- *Develop Learning Techniques*: A unit of instruction with techniques for easier memorization. Activity Sheets will help students memorize light exposure requirements, uses, spacing, height, flower colors, time of bloom, and propagation for thirty plants. Available from the Resource Center, Oklahoma State Department of Vocational and Technical Education, 1500 W. Seventh Avenue, Stillwater, Oklahoma 74074, in Oklahoma call 1-800-522-5810, out of Oklahoma call 1-800-654-4502.

**UNIT REFERENCES**

- *Horticultural Occupations*, College Station: Texas A & M University, 1985.
- *Park Seed Flowers and Vegetables 1989*, Greenwood, SC: Park Seed Company, 1988.
- Reiley, H. Edward & Carroll L. Shry, Jr., *Introductory Horticulture*, 2nd edition. Albany, N.Y.: Delmar, 1988.

**INFORMATION SHEET**

# INTRODUCTION TO GARDEN FLOWERS

# XXI

**OBJECTIVE 1**

**Match terms associated with garden flowers to their correct definitions.**

- **Annual**—A plant that completes its life cycle in one growing season. It is grown from seed and produces foliage, roots, blooms, and seeds in one season, then dies with the fall frosts.

  NOTE: In frost-free climates, some annuals will grow as perennials. Annuals usually have a longer blooming season than perennials.

  EXAMPLES: Petunia, zinnia, marigold

- **Biennial**—A plant that requires two years to complete its life cycle. It grows from seed. The first year a biennial produces foliage and a root system. It blooms and seeds the second year, then dies with the fall frosts.

  EXAMPLES: Sweet William (*Dianthus barbatus*), Canterbury bells (*Campanula medium*), foxglove (*Digitalis*)

- **Perennial**—A plant that lives more than two seasons. It may be grown from seed or by other propagation methods. A perennial blooms year after year, often dying back to the roots during the winter.

  NOTE: In colder climates, some perennials will grow as annuals, dying with winter cold.

  EXAMPLES: Blue salvia (*Salvia*), poppy (*Papaver*), columbine (*Aquilegia*)

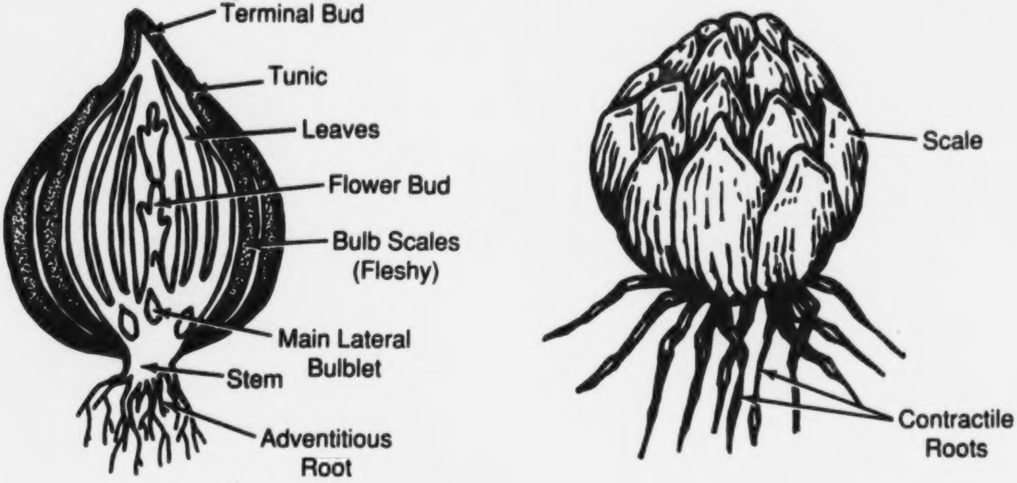
- **Hybrid**—Cultivar or species bred for a particular desirable trait.

**OBJECTIVE 2** **Match plant structures to their correct names.**

- **Bulb**—An underground bud of a flowering perennial that survives the winter as a dormant, fleshy globe consisting of overlapping layers of scales (leaves). (Figure 1)

  EXAMPLES: Tiger lily, tulip

  FIGURE 1


Terminal Bud
Tunic
Leaves
Flower Bud
Bulb Scales (Fleshy)
Main Lateral Bulblet
Stem
Adventitious Root
Scale
Contractile Roots

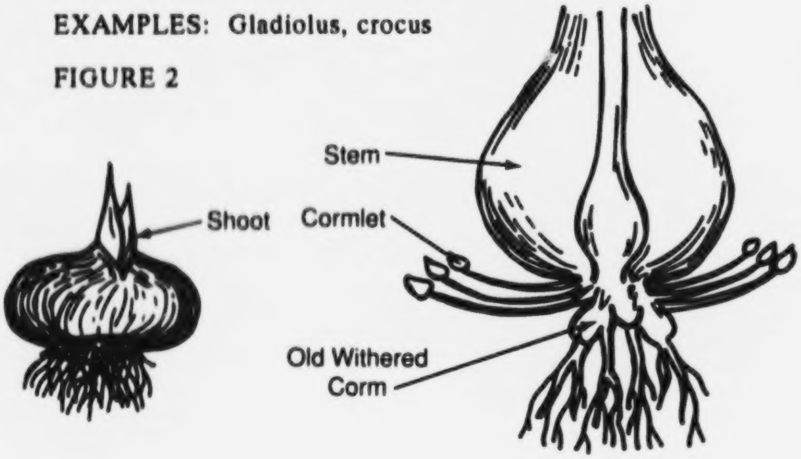
a. Bulb
(tunicate: non-scaly, tulip)

b. Scaly bulb (lily)

- **Corm**—A compact, globe-shaped underground stem, having nodes but no scales (leaves). (Figure 2)

  EXAMPLES: Gladiolus, crocus

  FIGURE 2

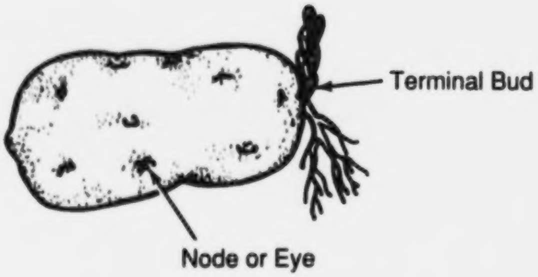

Shoot
Stem
Cormlet
Old Withered Corm

- **Tubers**—Underground fleshy root or stem that reproduces by growing roots from an eye. (Figure 3)

  **NOTE:** The eye of a tuber is also called a "bud."

  EXAMPLES: Elephant's Ear (*Caladium*), tuberous begonia

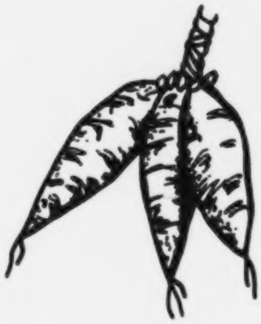
  FIGURE 3



- **Tuberous roots**—Large, fleshy roots that grow foliage and flowering shoots from the stem end. (Figure 4)

  EXAMPLE: Dahlia

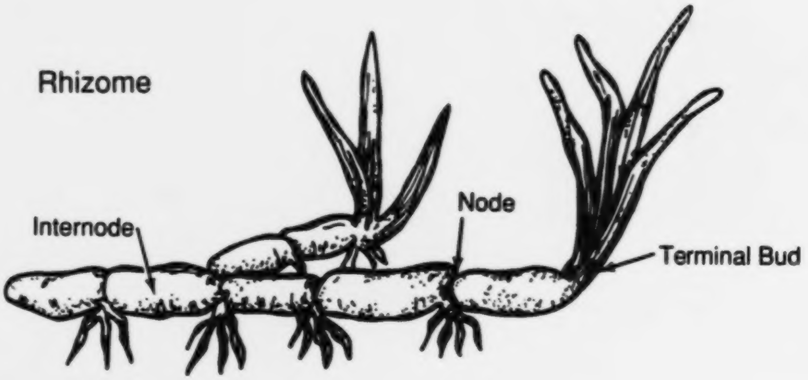
  FIGURE 4



- **Rhizome**—Underground stem with nodes that produce roots from the lower surface and leaves and flowers from the upper surface. (Figure 5)

  EXAMPLES: Iris, bamboo, sugar cane, some begonia varieties

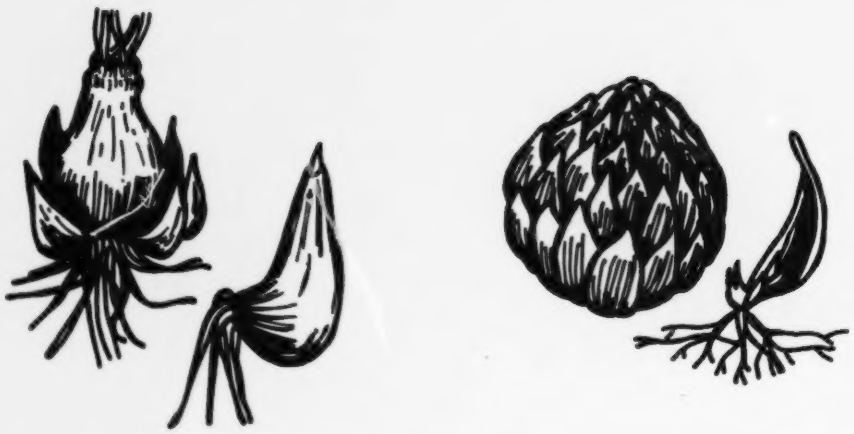
  FIGURE 5



**OBJECTIVE 3** **Match perennials with their correct propagation methods.**

- **Bulbs**—Separation (Figure 6)

  FIGURE 6



a. **Bulb separation** b. **Scale separation**

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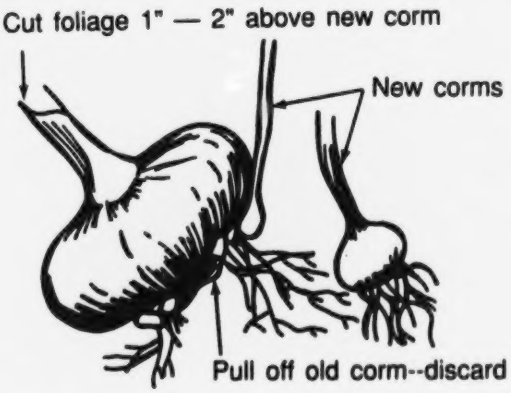
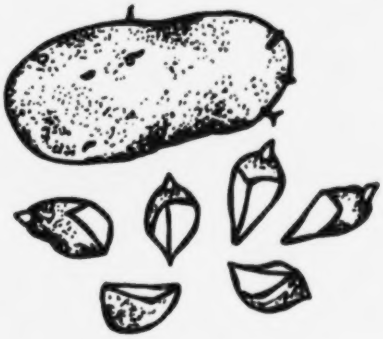
- **Corms**—Separation (Figure 7)

FIGURE 7


Cut foliage 1" — 2" above new corm
New corms
Pull off old corm--discard

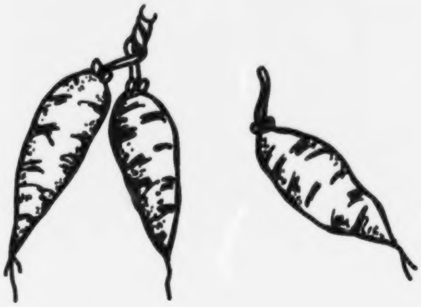
- **Tubers**—Division at the eyes (Figure 8)

FIGURE 8



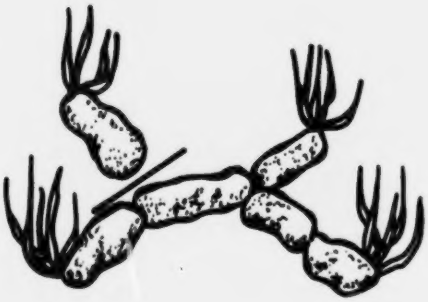
- **Tuburlar roots**—Division of root sections (Figure 9)

FIGURE 9



- **Rhizomes**—Division between nodes (Figure 10)

FIGURE 10



**OBJECTIVE 4** **Describe uses of garden flowers.**

- **Edging**—Low-growing flowers or ground cover placed along the outer borders of the planting bed

  EXAMPLES: Alyssum (*Lobularia maritima*), dwarf marigold, monkey grass (*Liriope*)

- **Cut flowers**—Bouquets and floral arrangements

  EXAMPLES: Chrysanthemums, daisies

- **Potted plant**—Grown in containers and tubs for interior decoration

  EXAMPLES: Hibiscus, geraniums, crocus, hyacinth, chrysanthemums

- **Hanging basket**—Flowers placed for color at eye level

  EXAMPLES: Petunias, pansies, dwarf marigolds

- **Mass plantings**—Flower beds, island beds and borders (Figure 11)

**OBJECTIVE 5** **Select from a list considerations for planting a flower bed or border.**

- Color scheme should create an overall aesthetic effect.

  EXAMPLE: Reds, oranges, and yellows give a bright, cheery, warm feeling to a garden. Blue flowers and deep green foliage create a more formal feeling.

- Color variety adds interest and creates a pleasing visual effect.

- Contrasting colors help create a visual focus.

  EXAMPLES: White or yellow flowers placed around a section of red flowers will make the red stand out.

- Plant height determines whether a plant is placed at the rear, center, middle, or edge of the bed. Tall plants are placed at the rear or center, medium-height plants in the middle, and short plants at the edges.

- Width of plants determine their spacing. A garden looks best when it looks full. Thinner plants may be spaced close together, bushy plants and wide plants are spaced to fill bare areas and create a thick, lush effect.

- Know the time of blooming and select varieties that will maintain a continuous show of color throughout the season. Planting should include early-summer species, midsummer species, and fall-blooming species.

- Select varieties that are compatible with the available light exposure in the garden area: full sun, partial shade, or full shade. Some plants will grow well in sun or shade.

- Border plantings should compliment the background.

  EXAMPLES: Colors should contrast with the fence, wall, or background trees and shrubs. Red flowers will stand out against a white fence, but they will be hard to see against a red wall. Tall varieties can be placed around buildings and along fencelines.

- Know the soil type and moisture level of the bed and select compatible plants that will thrive in those conditions.

NOTE: Soil analysis is available through the County Extension Service.

**OBJECTIVE 6**

**State general soil type and pH range for garden soils.**

- A good garden soil should have a good water-holding capacity and good drainage.

  NOTE: The ideal soil is sandy loam with plenty of organic matter. Even clay soil, if it is mixed with gypsum and organic matter, will make good garden soil.

- pH for most garden flowers is between 6.0 and 7.5.

  NOTE: Most flowers will grow in the range of neutral soils. Some will do much better in an acidic soil. These are listed below. Check a pH table when planning to use them.

  Plants that prefer acid soil - pH 4.0-6.0

  Azalea
  Bells of Ireland
  Butterfly weed
  Cardinal flower
  Chrysanthemum
  Lily
  Lily of the valley
  Marigold

**OBJECTIVE 7**

**Describe light exposure requirements and characteristics of ten varieties of annuals.** (Table 1)

EXAMPLE:

| Name | Light Exposure | Use | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
| **Cosmos** | Full sun | Cut flowers, background | 12-18 | 36 | white, rose, crimson, orange | Midsummer to frost |
| **Petunia** | Full sun to partial shade | Edging, border, planters, bedding | 10-15 | 10-15 | Bi-color, white, pink red, salmon, blue, purple | Summer fall |

**OBJECTIVE 8** **Describe light exposure requirements and characteristics of two varieties of biennials** (Table 2).

EXAMPLE:

| Name | Light Exposure | Use | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
| **Canterbury bells** | Sun to partial shade | Borders, ground cover, edging, rock gardens | 9-15 | 24-48 | White, pink, yellow, blue | Summer fall |

**OBJECTIVE 9** **Describe light exposure requirements and characteristics of ten flowering perennials** (Table 3).

EXAMPLE:

| Name | Propagation | Light Exposure | Use | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|---|
| **Daylily** | Division every fall | Full sun | Border, cut flowers | 24 | 18-48 | Yellow, orange, rusty reds, pink | May - July |

**OJECTIVE 10** **Describe light exposure requirements and characteristics of five ground covers and vines** (Table 4).

EXAMPLE:

| Name | Propagation | Light Exposure | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
| **Monkey grass—Liriope** | Divisions in fall or spring | AM sun PM shade, shade | 12-15 | 9-20 | Lavender to purple | April-June |

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**OBJECTIVE 11**

**Describe light exposure requirements and characteristics of three bulb species** (Table 5).

EXAMPLE:

| Name | Propagation | Light Exposure | Use | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|---|
| **Tulip** | Fall separation | Full sun | Borders rock gardens | 6 apart<br>8 deep | 4-18 | All | March-May |

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## Make Your Own Planting Charts.

You will have to choose ten annuals, ten perennials, two biennials, five ground covers, and three bulbs to learn for the written test. You will have to learn and memorize their names, light requirements, uses, spacing, height, flower colors, and time of bloom.

This much memorization is a big job.

Use this Activity Sheet to list the plants you choose and fill in the practice charts. Then use the charts to learn and memorize your answers for the test.

List your annuals (10)

1.______________________________
2.______________________________
3.______________________________
4.______________________________
5.______________________________
6.______________________________
7.______________________________
8.______________________________
9.______________________________
10.______________________________

List your biennials (2)

1.______________________________
2.______________________________

List your perennials (10)

1. __________
2. __________
3. __________
4. __________
5. __________
6. __________
7. __________
8. __________
9. __________
10. __________

List your ground covers and vines (5)

1. __________
2. __________
3. __________
4. __________
5. __________

List your bulbs (3)

1. __________
2. __________
3. __________

## TABLE 1 GARDEN ANNUALS

| NAME | LIGHT EXPOSURE | USES | SPACING* (inches) | HEIGHT (inches) | FLOWER COLORS | TIME OF BLOOM |
|---|---|---|---|---|---|---|
| Ageratum | Full sun to partial shade | Edging, borders, cut flowers | 9-12 | 6-18 | Mainly blue, plus pink, white | Summer, fall |
| Alyssum | Full sun or light shade | Beds, borders, edging, window boxes, baskets | 8-12 | 4-12 | White, pink, lavender-purple | Midsummer to frost |
| Amaranthus | Full sun | Bedding, background | 18-24 | 36-48 | Colorful foliage | Summer, fall |
| Balsam (Lady's Slipper) | Full sun or semi-shade | Bedding, borders, edging | 12-18 | 10-24 | Red, pink, white, purple, salmon, bicolors | Summer & fall |
| Begonia (Fibrous-rooted) | Shade | Planters, low edging, bedding | 8-12 | 6-24 | White, pink, red, with green or bronze foliage Singles and a few doubles | Summer |
| Bells of Ireland | Full sun | Cutting, fresh, dried | 18 | 24 | White with green bracts | Spring, summer |
| Browallia | Partial shade to full sun | Borders, bedding, baskets, window boxes | 6-10 | 8-16 | Blue, white | Summer, fall |
| Calendula | Full sun | Cutting, bedding, borders | 12 | 12 | Cream, gold, orange, yellow | Early summer to fall |
| Calliopsis | Full sun | Bedding, border, cutting | 8-12 | 8-30 | Yellow, orange, mahogany | Summer |
| Capiseum (Ornamental pepper) | Full sun | Bedding, border, cutting | 8-12 | 6-12 | Yellow, orange, mahogany | Summer |
| Carnation (annual) | Full sun to partial shade | Cutting, bedding | 8-12 | 15-20 | White, pink, red, yellow, bicolors | Early summer to fall |

* A good rule of thumb is to leave a space between plants equal to half of their height.

## TABLE 1 (Cont.) GARDEN ANNUALS

| NAME | LIGHT EXPOSURE | USES | SPACING* (inches) | HEIGHT (inches) | FLOWER COLORS | TIME OF BLOOM |
|---|---|---|---|---|---|---|
| Castor Bean | Full sun | Border or background | 48 | 48-120 | | |
| Celosia (Cockscomb) | Full sun | Cutting, border, edging, bedding, dried | 8-12 | 8-48 | Shades of red, yellow, pink, gold, orange, bicolor | Midsummer to fall |
| Centaurea (Cornflower) | Full sun | Cutting, bedding, border | 12 | 16-30 | White, red, pink, blue, bicolor | Early to midsummer |
| Chrysanthemum (annual) | Full sun | Cut flower, bedding | 8-12 | 8-16 | All colors, bicolors | Summer & fall |
| Cleome (Spiderflower) | Full sun to partial shade | Background, bedding, cut flowers | 12-18 | 48-60 | Pink, white | Summer |
| Coleus | Full sun to partial shade | Edging, foliage | 12-18 | 18-30 | Many colors | All season |
| Cosmos | Full sun | Cutting, background | 12-18 | 36 | White, rose, crimson, orange | Midsummer to frost |
| Dianthus (annual pinks) | Full sun to partial shade | Edging | 6-9 | 8-12 | Red, pink, white, variegated | Summer, fall |
| Dusty Miller | Full sun | Edging, foliage | 8-12 | 6-18 | Whitish green | All season |
| Gaillardia (annual) | Full sun | Cutting, bedding | 12 | 15-20 | Red, yellow, combinations | Summer, fall |
| Geranium (seed) | Full sun | Border, bedding, planters | 12-18 | 24 | Red, white, pink, salmon, bicolored | Summer, fall |

*A good rule of thumb is to leave a space between plants equal to half of their height.

TABLE 1 (Cont.)

## GARDEN ANNUALS

| NAME | LIGHT EXPOSURE | USES | SPACING* (inches) | HEIGHT (inches) | FLOWER COLORS | TIME OF BLOOM |
|---|---|---|---|---|---|---|
| Gomphrena (Globe Amaranth) | Full sun | Cutting, bedding, drying, edging | 8-12 | 12-24 | White, rose, purple, bicolor | Summer, fall |
| Helichrysum (Strawflower) | Full sun | Cut flowers, boarders, drying | 8-12 | 15-30 | Red, bronze, gold, white | Summer |
| Impatiens (Sultana) | Partial shade | Planters, bedding | 12 | 12-30 | Red, pink, salmon, orange, purple, white, bicolor | Summer |
| Lobelia | Partial shade | Edging, window box, basket | 6 | 4-8 | White, blue shades | Spring, summer |
| Marigold | Full sun | Border, bedding, cutting | 8-12 | 6-36 | Orange, gold, mahogany, yellow, bicolors | Summer & fall |
| Matricaria (Feverfew) | Full sun to partial shade | Cutting, bedding | 9-12 | 8-24 | Yellow to white | Summer, fall |
| Nasturtium | Full sun | Borders, bedding, cutting | 10-18 | 12-18 | Yellow, red, salmon, orange | Summer, fall |
| Nicotiana (Flowering tobacco) | Full sun | Border, bedding | 12-15 | 15-24 | White, red, pink, chartreuse | Midsummer to frost |
| Nierembergia (Cupflower) | Full sun | Edging, rock gardens | 9 | 6-9 | Blue-purple | Summer, fall |
| Pansy | Partial shade to full sun | Edging, bedding, cutting | 6-8 | 6-12 | Purple, yellow, white, red, bronze, many bicolors | Spring & summer |
| Periwinkle | Full sun to partial shade | Borders, bedding, ground cover | 9-15 | 6-18 | White, rose-pink, white-red eye, rose-red eye, rose | Summer to frost frost |

* A good rule of thumb is to leave a space between plants equal to half of their height.

TABLE 1 (Cont.)

## GARDEN ANNUALS

| NAME | LIGHT EXPOSURE | USES | SPACING* (inches) | HEIGHT (inches) | FLOWER COLORS | TIME OF BLOOM |
|---|---|---|---|---|---|---|
| Petunia | Full sun to partial shade | Edging, border, planters, bedding | 10-15 | 10-15 | Bicolor, white, pink, red, salmon, blue, purple | Summer, fall |
| Phlox, drummond (annual) | Full sun to partial shade | Bedding, border | 8-12 | 6-20 | All but yellow | Summer, fall |
| Portulaca (Rose Moss) | Full sun | Edging, rock garden | 8 | 6 | Pink, red, white, yellow, salmon, doubles & singles | Summer, fall |
| Rudbeckia (Coneflower) | Full sun | Cutting, background | 15 | 36 | Yellow, gold, mahogany | Summer & fall |
| Salvia | Full sun to partial shade | Bedding, borders, cut flowers | 9-15 | 8-30 | Mainly reds, salmon, pink, violet, white | Summer, fall |
| Scabiosa (Pincushion flower) | Full sun | Borders, cut flowers | 10-15 | 15-36 | White, pink, blue | Summer, fall |
| Snapdragon | Full sun to partial shade | Cutting, borders, bedding | 8-12 | 6-36 | Bronze, pink, rose, yellow, orchid, red, white, orange, lavender | Early summer to fall |
| Sweet Peas | Full sun | Cutting, mostly vines on fence | 5 | 12-72 | All colors | Early summer |
| Verbena | Full sun to partial shade | Borders, edging, bedding | 9-12 | 8-12 | All colors but yellow | Summer to frost |
| Zinnia | Full sun | Cutting, borders, bedding, edging | 9-12 | 6-36 | Red, orange, yellow, pink, white, purple, bicolors, salmon, crimson | Summer |
| | | | | | | |

*A good rule of thumb is to leave a space between plants equal to half of their height.

## TABLE 2

# GARDEN BIENNIALS

| NAME | LIGHT EXPOSURE | USES | SPACING (inches) | HEIGHT (inches) | FLOWER COLORS | TIME OF BLOOM |
|---|---|---|---|---|---|---|
| Canterbury Bells | Sun to partial shade | Borders, ground cover, edging, rock gardens | 9-15 | 24-48 | White, pink, yellow, blue | Summer, fall |
| Foxglove | Partial shade to full sun | Back of border | 12-15 | 36-60 | White, cream, pink, rose, purple | Midsummer |
| Sweet William | Full sun | Border, edging | 6-10 | 6-18 | All | Early to midsummer |

## TABLE 3 FLOWERING PERENNIALS

| NAME | *PROPAGATION | LIGHT EXPOSURE | USES | SPACING | HEIGHT | FLOWER COLORS | BLOOM TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Alyssum (perennial) | *Division - fall every 3rd yr. | Full Sun | Edging borders, window boxes, rock gardens | 6"-8" | 9"-12"<br>18" spread | Yellow | April | Save blooms for dry arrangements. |
| Asclepias (Butterfly Flower) | Do not move | Full Sun | Mass plantings, border, cut flowers | 24" | to 3' | Orange | May-Sept. | Good for dry, poor soil |
| Candytuft Evergreen | *Division - fall every 3rd yr. | Full Sun<br>Sun/ a.m. Shade/p.m. | Beds, edging | 12"-15" | 8" -12"<br>20" spread | White | End of April-June | Foliage green year-round. |
| Canna | Dig every fall | Full Sun | Border, cut flowers | 12"-15" | 16"-6' | Lavender, red, orange, pink, yellow | July- Aug. Oct. | If protected on the south side, it will grow as a perennial. |
| Columbine | *Division - fall every 3rd yr. | A.M. Sun<br>P.M. Shade | Border, cut flowers, rock garden | 12"-15" | 18"-24" | Pastel colors | April-May | |
| Coreopsis | *Division - fall every 3rd yr., seed | Full Sun | Border, cut flowers | 18"-24" | 24"-36" | Yellow, orange, red | May-Oct. | Tolerates drought and poor soil. Must be controlled or will take over. |
| Chrysanthemum | Division early spring every 3rd yr. plant 3" size - spring. Gal. can size - fall | Full Sun | Border, cut flowers | 24" | 18"-24" | Yellow, pink, white, bronze reds | Sept.-Nov. | Keep pinched back for short, compact plants. |
| Daylily | Division of root system - fall | Full Sun | Border, cut flowers, background | 24" | 18"-48" | Yellow, orange, rusty reds, pink | May-July | |
| Gaillardia | *Division - fall every 2nd year | Full Sun | Border, cut flowers | 24" | 24"-30" | Yellow, reds | May-Nov. | May need staking |
| Hibiscus (Rose Mallow) | Seed - Division | Sun | Border, screen, or background | 3'-6' | 3'-6' | White, pink, red | July-Oct. | Large show of flowers |
| Hollyhock | *Sow seed April | Sun | Border, screen | 24" | 5'-6' | White, pink, rose, yellow, reds | June-Sept. | Excellent for background |

*These plants can be planted in 2"-2 1/2" pots, Oct. 1-Nov. 15 or after March 10.

TABLE 3 (Cont.)

## FLOWERING PERENNIALS

| NAME | *PROPAGATION | LIGHT EXPOSURE | USES | SPACING | HEIGHT | FLOWER COLORS | BLOOM TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Hosta | Division | Shade-<br>Pt. Shade | Ground cover or edging, tall variety for background | 12"-24" | 6"-24" | Foliage in greens, blue, and variegated | Aug.-Sept. | Great shade plant |
| Iris<br>Bearded or German | Division of rhizomes-every 3rd to 4th yr.-fall | Sun | Borders,<br>cut flowers | 24" | 24"-42" | White, purple, yellows, combinations | April-June | Tough, good for holding embankments or wash-outs |
| Liatris | Seed-started plants | Sun | Borders,<br>cut flowers | 12"-18" | 3'-5' | Purple, white | July-Sept. | Tolerates hot, dry, poor soil |
| Lilly | Seed-started plants | Pt. shade | Borders,<br>cut flowers | 12" | 18"-5' | All | June-Oct. | May need staking |
| Peony | Do not ever divide if possible, but if necessary not before 3 yrs., 3 to 4 eye tubers, one gallon cont. | A.M. Sun<br>P.M. Shade | Borders,<br>background | 24" | 18"-24" | Whites, pinks, roses | May | Make separate bed. Don't plant over 2" under soil |
| Poppy | *Division of roots every 3rd yr. - fall | Full Sun | Borders,<br>cut flowers | 12" | 15"-18" | Reds, orange, pinks, blues | April-May | Do not like wet feet |
| Phlox<br>(Summer) | Division every 3 to 5 yr. - fall, after blooming, one gal. cont. | Full Sun | Borders,<br>cut flowers | 12" | 18"-24" | Pinks, white, reds | May-Sept. | May need to stake, unless dwarf varieties are used |
| Phlox<br>(Creeping) | *Division of clump - fall | Full Sun | Borders,<br>edging | 12" | 6"-8" | Pink, white, blue | April-May | Slow to get started - almost evergreen |
| Pinks | Division | Sun-Pt. shade | Borders, edging, cut flowers | 12" | 8"-14" | White, pink, coral | April-June | |
| Red Hot Poker | *Division - fall every 5 yrs., seed | Full Sun | Borders,<br>cut flowers | 12" | 24"-36" | Red orange, yellow | May-June | Well-drained soil |
| Rose | Plants started/stem cuttings | Sun | Borders,<br>cut flowers | 1'-3' | 12"-10' | All | April-Nov. | Needs good air circulation, use systemic insecticide/fungicide |

*These plants can be planted in 2"-2 1/2" pots, Oct. 1-Nov. 15 or after March 10.

## TABLE 3 (Cont.) FLOWERING PERENNIALS

| NAME | *PROPAGATION | LIGHT EXPOSURE | USES | SPACING | HEIGHT | FLOWER COLORS | BLOOM TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Rudbeckia | *Division - fall every 3 yrs. | Full Sun | Beds, borders, cut flowers | 12" | 24"-30" | Yellow, brown center | June-Nov. | May need some staking unless dwarf varieties are used |
| Salvia<br>(Farinacea)<br>(Nemorosa) | Seed | Sun - Pt. shade,<br>Sun - Pt. shade | Beds, borders | 8" | 18"-24"<br>24"-36" | Blue, white | May-Nov.<br>June-Aug. | Can tolerate dry soil |
| Shasta Daisy | Division - fall every 3-4 yrs., 1 gal. cont. | Full Sun | Borders, cut flowers | 15"-18" | 24"-30" | White, yellow center | June-July | Cut off DEAD blooms |
| Sedum (Dragon Blood, Gold Moss, Autumn Joy) | Division | Full Sun | Edging, foliage, rock garden, ground cover | 4"-12" | 2"-24" | Red, grey-green, copper red | May-Nov. | Good groundcover |

*These plants can be planted in 2"-2 1/2" pots, Oct. 1-Nov. 15 or after March 10.

## TABLE 4 GROUND COVERS AND VINES

| NAME | *PROPAGATION | LIGHT EXPOSURE | SPACING (inches) | HEIGHT (inches) | FLOWER COLORS | BLOOM TIME | COMMENTS |
|---|---|---|---|---|---|---|---|
| Ajuga | *Division - fall every 3rd yr. | Full Sun - best<br>A.M. Sun, P.M. Shade | 12" | 6"-10" | Blue | April-May | Do not plant crown below soil surface |
| Bishop's Weed | *Rooted runners - fall or spring | A.M. Sun, P.M. Shade | Runners every 4"-6" | 4" | Grown for green and white foliage | Not showy | |
| Boston Ivy | *Rooted runners - early fall or spring | A.M. Sun, P.M. Shade | Runners every 4"-6" | Vine | Foliage | Not showy | Red fall color,<br>For limited areas plant dwarf cultivars |
| Euonymus Coloratus | *Rooted runners - early fall or spring | Full Sun,<br>A.M. Sun, P.M. Shade | 4"-6" | 12" | Foliage | Not showy | Purple fall and winter color |
| English Ivy | *Rooted or non-rooted, runners early fall or spring | Shade, A.M. Sun, P.M. Shade | Juvinelle runners every 4"-6" | 6"-10" also vines | Foliage | Not showy | Can damage wooden structures |
| Ground Ivy | *Rooted runners - fall or early spring | Shade, A.M. Sun, P.M. Shade | Clumps or runners every 4"-6" | 6"-10" | Foliage | Not showy | |
| Monkey Grass - Liriope | *Division fall or early spring | Shade, A.M. Sun, P.M. Shade | 12"-15" | 8"-20" | Lavender to purple | April-June | Good for edging, prune in March to remove old foliage |
| Mondo Grass - Ophopogon | *Division fall and early spring | Shade, A.M. Sun, P.M. Shade | 8"-10" | 6"-12" | White | Not showy | Good for edging, prune in March to remove old foliage |
| Moneywort | *Rooted runners - fall or early spring | Shade, A.M. Sun, P.M. Shade | Clumps 4"-6" apart | 3"-4" | Foliage - green and gold varieties | Not showy | |
| Potentilla | *Rooted runners - fall or early spring | A.M. Sun, P.M. Shade | Clumps 4"-6" apart | 10"-12" | Not showy | Not showy | Fast grower |
| Pachysandra | *Division fall or early spring | A.M. Sun, P.M. Shade, Shade | Clumps 4"-6" apart | 10"-12" | Creamy white | Not showy | Needs protection from wind |

*These plants can be planted in 2"-2 1/2" pots, Oct. 1-Nov. 15 or after March 10.

TABLE 4 (Cont.)

## GROUND COVERS AND VINES

| NAME | *PROPAGATION | LIGHT EXPOSURE | SPACING (inches) | HEIGHT (inches) | FLOWER COLORS | BLOOM TIME | COMMENTS |
|---|---|---|---|---|---|---|---|
| Santolina | *Fall or early spring - rooted stems, one gallon | Full Sun | 10"-12" | 12"-18"<br>spread 3"-5" | Bloom - yellow<br>Foliage - gray or green | June- Aug. | Remove old blossoms and prune back in August |
| Sedum | *Division fall or early spring | Sun, A.M. sun, P.M. shade | 6"-8" | 4"-12", depends on cultivar | Red, pink, yellow, depends on cultivar | May-July | Stonecrops - yellow blooms, Dragonsblood - red foliage<br>Rock Gardens |
| Vinca major | *Fall or early spring - rooted runners | A.M. sun, P.M. shade, shade | 8"-10" | 12"-18" | Lavender, blue | April-May | Loses leaves in late fall |
| Vinca minor | *Fall or early spring, rooted runners | A.M. sun, P.M. shade, shade | 4" | 4"-6" | Blue, white, purple | April-May | Very slow grower, retains foliage all winter |

*These plants can be planted in 2"-2 1/2" pots, Oct. 1-Nov. 15 or after March 10.

TABLE 5

## BULBS

| NAME | *PROPAGATION | LIGHT EXPOSURE | USES | SPACING | HEIGHT | FLOWER COLORS | BLOOM TIME | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| Crocus | Bulbs - fall | Sun | Early beds and borders, edging | 3" apart, 4" deep | 3"-4" | White, yellow, lavender | Feb.-March | Need well-drained soil |
| Hyacinth | Bulbs - fall | Sun | Beds, borders, cut flowers | 5" apart, 8" deep | 8"-12" | White, pink, blue | Mar.-April | Need well-drained soil |
| Narcissus<br>Daffodils<br>Jonquils | Bulbs - fall | Sun | Beds, borders, cut flowers | 6" apart, 8" deep | 8"-18" | Various, mostly yellow, white | Mar.-April | Need well-drained soil |
| Tulips | Bulbs - fall | Sun | Beds, borders, cut flowers | 6" apart, 8" deep | 4"-18" | Various | March-May | Need well-drained soil |

# ASSIGNMENT SHEET 1 | INTRODUCTION TO GARDEN FLOWERS XXI

NAME ______________________________ SCORE ______

**OBJECTIVE 12** **Select compatible varieties of flowers to be planted in full sun and partial shade.**

**INTRODUCTION**

Every flower garden or border is designed with light requirements, height, color, and bloom time in mind. The first step in planning a garden is to select species of flowers that are compatible. That is, flowers that have the same light requirements, a range of heights from tall to short, and colors that go together or that create a contrast.

**COLORS:** You can easily recognize colors that blend together to make a pretty combination. A few examples are pink and white, a pale yellow and a light orange, pink and purple, yellow and white, red and pink, members of the same family of colors, and almost all pastels.

Contrasting colors create a striking difference so that the flowers stand out rather than blend together. For example, planting white or yellow flowers around a section of red flowers will make the red show more brilliantly. Yellows and purples planted together draw the eye because of the intense contrast between these two colors.

A variety of colors creates a pleasing visual effect.

Color can also create moods or feelings. For example, blue is a cool color that is relaxing and suggests a formal feeling. White and yellow are neutral colors that can be used with any other colors. Reds and oranges are hot colors that are exciting and suggest a bright, informal feeling.

**DIRECTIONS**

Use the charts of annuals, biennials, perennials, ground covers, and bulbs in the Information Sheet and select compatible flowers as indicated.

For each light exposure condition, choose at least six plants. Include flowers that meet these criteria (1) tall, medium, and low-growing (2) bloom from May (or earlier) until fall and (3) offer a variety of colors that will be attractive and pleasing to the eye.

1. Full sun

2. Partial shade

3. Find and list three perennials that tolerate dry conditions.

4. Use resources available in your classroom to find at least three other garden flowers or ground covers that require moist soil.

| Name | Height | Bloom Time | Color |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

NAME ______________________________ SCORE ______

**OBJECTIVE 13**

**Plan a garden or border using a variety of annuals, biennials, and perennials.**

**INTRODUCTION**

Flower gardens or borders, especially when they have been carefully designed, add beauty, color, and pleasure to our lives. A border on the front of an ordinary house can turn it into a distinctive, attractive home. Cut flowers can provide color and fragrance indoors all season.

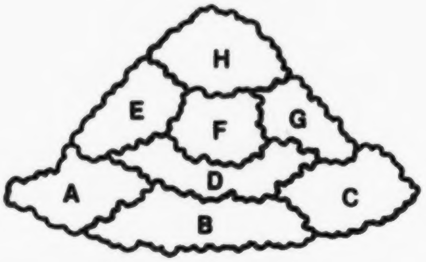
**DIRECTIONS**

Plan a flower garden or a border to compliment the home. USE ANNUALS, BIENNIALS, AND PERENNIALS. You may use ground covers, vines, and bulbs if you wish.

Read all the information in this Assignment Sheet, then answer the questions. Use the tables in the Information Sheet and the charts you made in Assignment Sheet 1.

Select the flowers you will use and list them on the page. Use no more than 8 varieties.

Draw your plan in the space provided, making line-boundaries where you will plant each variety. Use the example as a model.



A—Alyssum, pink and white mixed
B—Baby's Breath (annual), rose
C—Globe amaranth, mixed colors
D—Petunias, pinks and blues
E—Marigolds, white
F—Cornflower, mixed colors
G—Dianthus (annual), white
H—Day lilies, pink

**Points to remember:**

- Tall flowers go in the rear or center, medium height in the middle, and low-growing plants at the edges.
- Choose plants with different times of bloom and keep color in the border or garden all summer.
- Decide on a color scheme or overall effect.

**Suggestion:** Look at a seed catalog, at colored slides, or other color pictures of flowers to get some ideas on color and varieties.

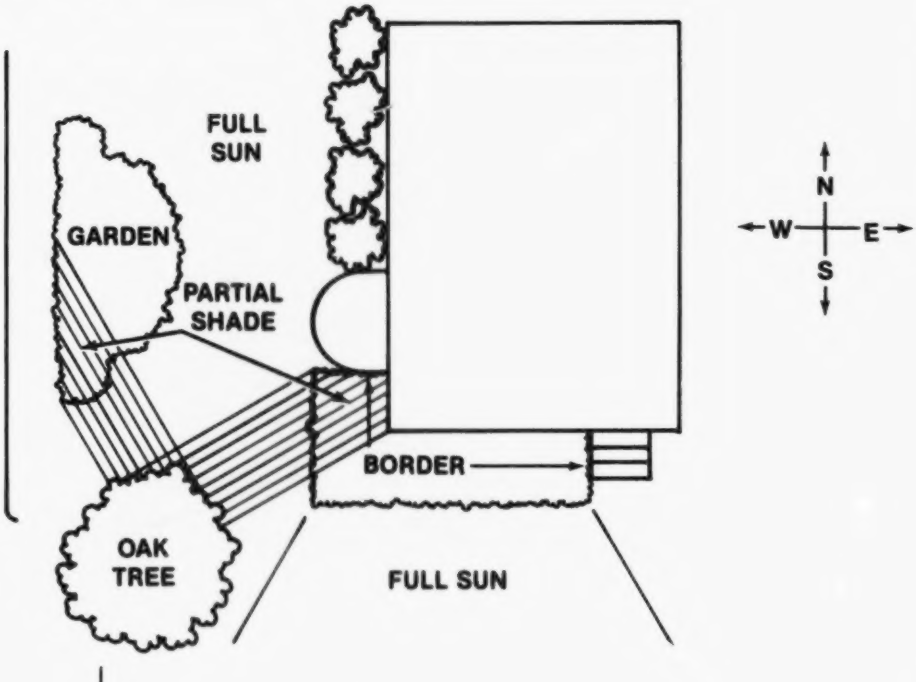
**The Andersons' House** is one story, white with blue trim on the windows, doorway, and garage. It faces west.

The Andersons want either a border from the door on the south around to the door on the west OR a garden in the front yard.

BORDER: The border on the south side is in full sun. However, the border on the west side is in partial sun. It doesn't get sunlight until the sun clears the roof in the morning, and then it is shaded by the big oak tree in the late afternoon.

GARDEN: The garden gets good morning sun, but in the afternoon the southern end is in partial shade because of the big oak tree. The north end of the garden gets full sun.

EXAMPLE:



Use this space for planning notes and ideas:

1316

NAME ______________________________ SCORE _______

Answer these questions:

Which area are you planning? ________________________

What colors do you plan to use? ________________________

______________________________________________

Special effects you want to create, if any ________________

______________________________________________

______________________________________________

List the flowers you will use. Write the letters you have used in the drawing before the name of the flower.

| Letter | Name | Height | Color | Time of Bloom |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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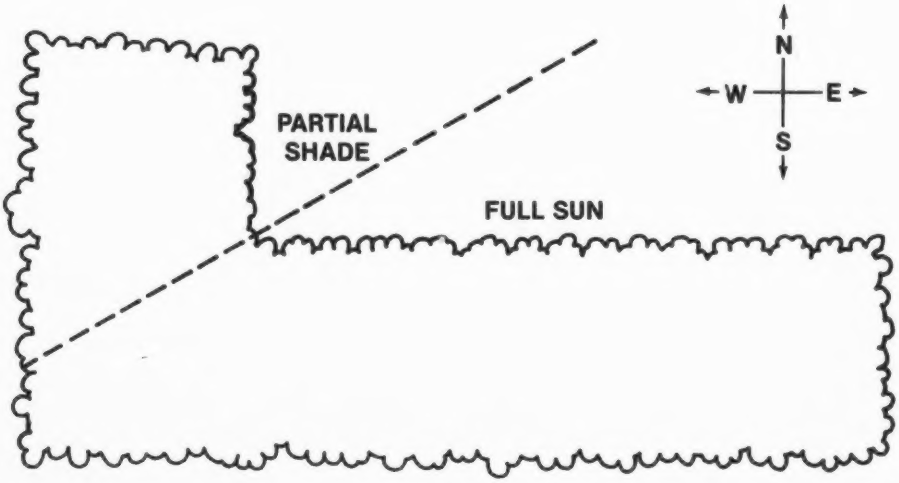
| | | | | |
| | | | | |

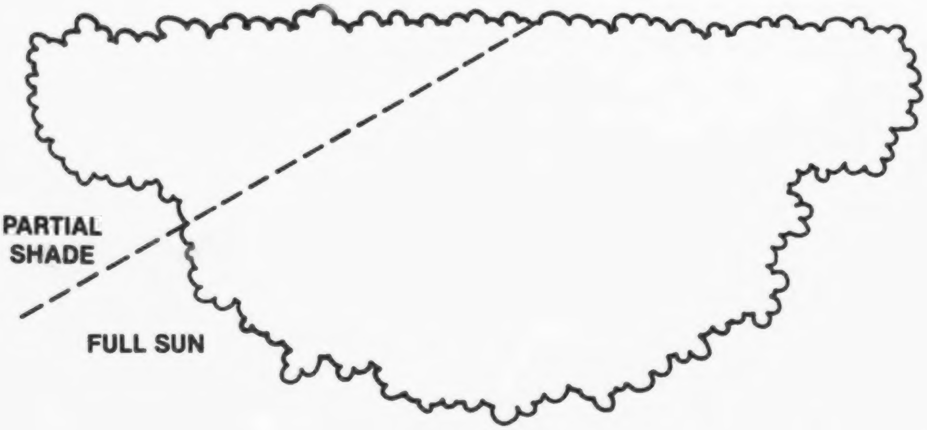
NAME ______________________________

Draw your plan.

**BORDER**


N
W
E
S
PARTIAL SHADE
FULL SUN

**GARDEN**


PARTIAL SHADE
FULL SUN

## ASSIGNMENT ANSWERS

## INTRODUCTION TO GARDEN FLOWERS

## XXI

### ASSIGNMENT SHEET 1

NOTE: Refer to Tables 1 through 4 for answers.

1. Check to be sure that plants selected require or will tolerate full sun; include tall, medium and short plants and a variety of colors.
2. Check that plants selected require or will tolerate partial shade; include tall, medium, and short plants and a variety of colors.
3. Student should include any three of the following
    - Asclepias (butterfly flower)
    - Coreopsis
    - Liatris lily
    - Salvia
4. Check that plants selected require moist soil.

### ASSIGNMENT SHEET 2

Completed to the satisfaction of the instructor. Plan should include annuals, biennials, perennials, and may include ground covers and bulbs. Height, color, and season-long blooming should be incorporated in the plan.

JOB SHEET 1

## INTRODUCTION TO GARDEN FLOWERS

## XXI

**OBJECTIVE 14a**

**Prepare a soil bed.**

**TOOLS AND MATERIALS**

- Shovel
- Spade or tiller
- Organic material as needed for specific garden soil: peat moss to aid in moisture retention or sand to provide better drainage and aeration.
- Fertilizer as needed

NOTE: Peat moss or sand should be added in the fall prior to planting.

**PROCEDURE**

1. If preparing a new bed, test the soil for drainage
    a. Dig a 10-inch hole.
    b. Fill hole with water.
    c. Fill again the next day.
    d. Check the soil in approximately ten hours.
    e. Evaluate drainage: If the soil has not absorbed the water within ten hours on the second day, the soil has poor drainage.
    f. Add sand or raise the bed level above the normal soil level and dig a shallow trench around it.
2. Spade or till the soil to loosen it.

    **CAUTION: If the bed contains bulbs, do not dig deeply enough to damage them.**

3. Fertilize as recommended.

    **CAUTION: Read label carefully. Follow directions for mixing and application.**

**NOTE:** If planting a perennial garden, soil must be especially well-prepared and fertilized as perennials remain in the soil for years. Adequate fertilizer should be dug into the soil along with organic matter to a depth of at least one foot.

4. Have your instructor check your work.

5. Put away tools and materials and clean the work area.

## JOB SHEET 2

## INTRODUCTION TO GARDEN FLOWERS

## XXI

**OBJECTIVE 14b**

**Grow flowering annuals from seed.**

**TOOLS AND MATERIALS**

- Garden plan or design
- Seeding media
- Flats with peat pots for larger seeds and/or flats without pots and 2" pots for smaller seeds
- Seeds
- Labeling tags
- Gentle watering system, either low-pressure spray or pans for bottom-watering flats
- Water soluble, high phosphate fertilizer mixed at the rate of one tablespoon per gallon of water.

**PROCEDURE**

1. Outline the plan in writing.
2. Set the approximate planting date according to the frost-free date for the area.
3. Seed six to eight weeks prior to frost-free date.

   NOTE: Some seeds can be seeded directly into prepared garden soil as soon as the soil can be worked.

   EXAMPLES: Baby's breath, cleome, cornflower (bachelor's buttons), globe amaranth, poppy, strawflower, sweet alyssum and sweet pea
4. Prepare the soil well in advance.
5. Fill flats with media.
6. Check recommended planting depth for each type of seed to be used.
7. Sow at proper depth one or two seeds in each pot, or carefully sprinkle rows of small seed onto loose-media flats.
8. Label plantings, including plant name, color, and date of sowing.

9. Water gently, either with a low-pressure spray or by setting the flat in a pan of water so moisture can come up through the bottom. Strive for even distribution of water on the seeds.

   **CAUTION: Do not use forceful water spray on very small seeds, such as petunia, or seeds will be washed down too deeply into the media.**

10. Transplant seedlings in loose media into larger pots after first true leaves appear.

11. Plant seedlings according to design after the frost-free date.

    NOTE: Follow spacing requirements on bedding charts or on seed packets.

12. Plant seedlings at about the same depth as the depth of the container they came from.

13. Pack soil firmly around the roots.

14. Water well.

15. Add fertilizer — one tablespoon of a water-soluble, high phosphate fertilizer in one gallon of water.

16. Have your instructor check your work.

17. Put away tools and materials and clean the work area.

## JOB SHEET 3 — INTRODUCTION TO GARDEN FLOWERS — XXI

**OBJECTIVE 14c**

**Care for plants after planting.**

**TOOLS AND EQUIPMENT**

- Watering system
- Mulch, if desired
- Pesticide spray, if needed and desired
- Fertilizer
- Knife, scissors or pruning shears

**PROCEDURE**

1. Water when soil becomes dry.
2. Pull weeds by hand, cut weed roots with a knife, or mulch to control weeds.
3. Remove all faded blossoms.
4. Use pest control products as needed to control insects.

   **WARNING** **If chemical pesticides are used, read label carefully, follow all instructions for mixing and application. Wear protective gloves. Do not spray in windy conditions.**

5. Fertilize as needed to keep plants actively growing.
6. Prune or pinch back plants to encourage growth.

   NOTE: Pinching or pruning will create a thicker, more attractive plant.

7. Cut the flowers for indoor enjoyment.
8. Have your instructor check your work.
9. Put away tools and clean the work area.

**OBJECTIVE 14a**

**Prepare a soil bed.**

**Student's name** ______________________ **Date** __________

**Evaluator's name** ______________________ **Attempt no.** ____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Prepared a new bed and tested the soil for drainage. | | |
| a. Dug a 10-inch hole. | ____ | ____ |
| b. Filled hole with water. | ____ | ____ |
| c. Filled again the next day. | ____ | ____ |
| d. Checked the soil within ten hours on the second day, to determine whether water was absorbed. | ____ | ____ |
| e. Evaluated the drainage. | ____ | ____ |
| f. Added sand or raised the bed level above the normal soil level and dug a shallow trench around it. | ____ | ____ |
| 2. Spaded or tilled the soil to loosen it. | ____ | ____ |
| 3. Fertilized as recommended. | ____ | ____ |
| 4. Used proper tools correctly. | ____ | ____ |
| 5. Performed steps in a timely manner. | ____ | ____ |
| 6. Practiced safety rules throughout procedure. | ____ | ____ |
| 7. Provided satisfactory responses to questions asked. | ____ | ____ |

**EVALUATOR'S COMMENTS**

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:

| | | | | |
|---|---|---|---|---|
| Loosened soil | 4 | 3 | 2 | 1 |
| Dug in organic matter and fertilizer | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

**AVERAGE RATING**

**Evaluation note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the Rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training

3 - Moderately skilled—Has performed job during training program; limited additional training may be required

2 - Limited skill—Has performed job during training program; additional training is required to develop skill

1 - Unskilled—Is familiar with process; but is unable to perform job

**PRACTICAL TEST 2**

## INTRODUCTION TO GARDEN FLOWERS

# XXI

**OBJECTIVE 14b**

**Grow flowering annuals from seed.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no. ___

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Outlined the plan in writing. | _____ | _____ |
| 2. Set the approximate planting date according to the frost-free date for the area. | _____ | _____ |
| 3. Seeded six to eight weeks prior to frost-free date. | _____ | _____ |
| 4. Prepared the soil well in advance. | _____ | _____ |
| 5. Filled flats with media. | _____ | _____ |
| 6. Checked recommended planting depth for each type of seed to be used. | _____ | _____ |
| 7. Sowed at proper depth one or two seeds in each pot, or carefully sprinkle rows of small seed onto loose-media flats. | _____ | _____ |
| 8. Labeled plantings, including plant name, color, and date of sowing. | _____ | _____ |
| 9. Watered gently, either with a low-pressure spray or by setting the flat in a pan of water. | _____ | _____ |
| 10. Transplanted seedlings in loose media into larger pots after first true leaves appeared. | _____ | _____ |
| 11. Performed steps in a timely manner. | _____ | _____ |
| 12. Practiced safety rules through procedure. | _____ | _____ |

| The student: | YES | NO |
|---|---|---|
| 13. Provided satisfactory responses to questions asked. | ____ | ____ |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Seeding | 4 | 3 | 2 | 1 |
| Transplanting to pots | 4 | 3 | 2 | 1 |
| Planting in the garden | 4 | 3 | 2 | 1 |
| Spacing and planting according to design | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

______________________________

______________________________

______________________________

### AVERAGE RATING

**Evaluation note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the Rating on the "Performance Evaluation Key" below.

### PERFORMANCE EVALUATION KEY

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**PRACTICAL TEST 3**

## INTRODUCTION TO GARDEN FLOWERS

## XXI

**OBJECTIVE 14c**

**Care for plants after planting.**

Student's name ______________________ Date __________

Evaluator's name ______________________ Attempt no.____

**Instructions:** When you are ready to perform this task, ask your instructor to observe the procedure and complete this form. All items listed under "Process Evaluation" must receive a "Yes" for you to receive an overall performance evaluation.

**PROCESS EVALUATION**

**Evaluator note:** Place a check mark in the "Yes" or "No" blanks to designate whether or not the student has satisfactorily achieved each step in this procedure. If the student is unable to achieve this competency, have the student review the materials and try again.

| The student: | YES | NO |
|---|---|---|
| 1. Watered when soil became dry. | _____ | _____ |
| 2. Pulled weeds by hand, cut weed roots with a knife, or mulched to control weeds. | _____ | _____ |
| 3. Removed all faded blossoms. | _____ | _____ |
| 4. Used pest control products as needed to control insects. | _____ | _____ |
| 5. Fertilized as needed to keep plants actively growing. | _____ | _____ |
| 6. Pruned or pinched back plants to encourage growth. | _____ | _____ |
| 7. Cut the flowers for indoor enjoyment. | _____ | _____ |
| 8. Used proper tools correctly. | _____ | _____ |
| 9. Performed steps in a timely manner. | _____ | _____ |
| 10. Practiced safety rules throughout procedure. | _____ | _____ |
| 11. Provided satisfactory responses to questions asked. | _____ | _____ |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**PRODUCT EVALUATION**

**Evaluator note:** Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See performance evaluation key). A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

| Criteria: | | | | |
|---|---|---|---|---|
| Watered | 4 | 3 | 2 | 1 |
| Controlled weeds | 4 | 3 | 2 | 1 |
| Safely controlled pests | 4 | 3 | 2 | 1 |
| Fertilized | 4 | 3 | 2 | 1 |
| Pruned | 4 | 3 | 2 | 1 |
| Overall appearance and health of garden | 4 | 3 | 2 | 1 |

**EVALUATOR'S COMMENTS**

________________________________________

________________________________________

________________________________________

**AVERAGE RATING**

**Evaluation note:** To obtain an average rating for the competency profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the Rating on the "Performance Evaluation Key" below.

**PERFORMANCE EVALUATION KEY**

4 - Skilled—Can perform job with no additional training
3 - Moderately skilled—Has performed job during training program; limited additional training may be required
2 - Limited skill—Has performed job during training program; additional training is required to develop skill
1 - Unskilled—Is familiar with process; but is unable to perform job

**WRITTEN TEST**

# INTRODUCTION TO GARDEN FLOWERS

# XXI

NAME ______________________ SCORE ______

**OBJECTIVE 1**

**Match terms associated with garden flowers to their correct definitions.** Write the correct letters in the blanks. (Question is continued on the following page.)

___ 1. A plant that requires two years to complete its life cycle; it grows from seed; the first year it produces foliage and a root system; it blooms and seeds the second year, then dies with the fall frosts.

___ 2. A compact, globe-shaped underground stem, having nodes but no scales (leaves)

___ 3. Underground fleshy root or stem that reproduces by growing roots from an eye

___ 4. Cultivar or species bred for a particular desirable trait

___ 5. Large, fleshy roots that grow foliage and flowering shoots from the stem end

___ 6. An underground bud of a flowering perennial that survives the winter as a dormant, fleshy globe consisting of overlapping layers of scales (leaves)

___ 7. A plant that lives more than two seasons. It may be grown from seed or by other propagation methods. It blooms year after year, often dying back to the roots during the winter

___ 8. A plant that completes its life cycle in one growing season; it is grown from seed and produces foliage, roots, blooms, and seeds in one season, then dies with the fall frosts

a. Adventitious roots

b. Annual

c. Biennial

d. Bulb

e. Canna

f. Corm

g. Deciduous

h. Fibrous root

i. Hybrid

j. Perennial

k. Rhizome

l. Tuber

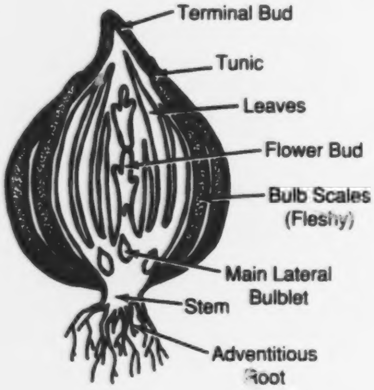
m. Tuberous roots

____ 9. **Underground stem with nodes that produce roots from the lower surface and leaves and flowers from the upper surface**

**OBJECTIVE 2**

**Match plant structures to their names.** Write the correct letters in the blanks.

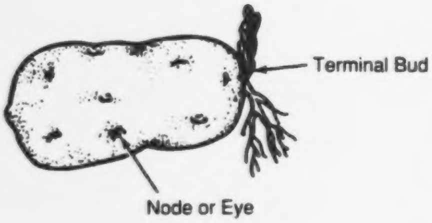
FIGURE 1


Terminal Bud
Tunic
Leaves
Flower Bud
Bulb Scales (Fleshy)
Main Lateral Bulblet
Stem
Adventitious Root

a. Tuberous root
b. Rhizome
c. Bulb
d. Tuber
e. Corm

1. ____________________

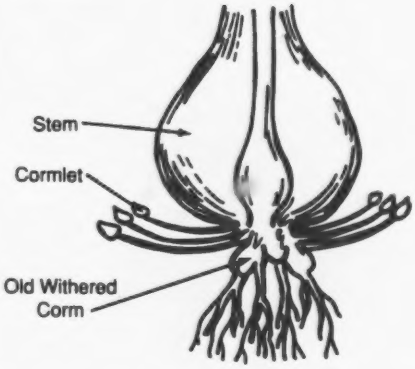
FIGURE 2


Terminal Bud
Node or Eye

a. Tuberous root
b. Rhizome
c. Bulb
d. Tuber
e. Corm

2. ____________________

FIGURE 3


Stem
Cormlet
Old Withered Corm

a. Tuberous root

b. Rhizome

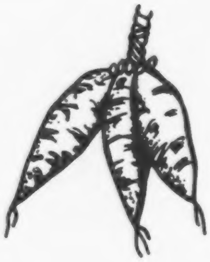
c. Bulb

d. Tuber

e. Corm

3.________________________

FIGURE 4



a. Tuberous root

b. Rhizome

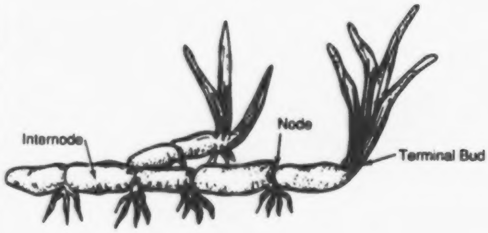
c. Bulb

d. Tuber

e. Corm

4.________________________

FIGURE 5


Internode
Node
Terminal Bud

a. Tuberous root

b. Rhizome

c. Bulb

d. Tuber

e. Corm

5.________________________

**OBJECTIVE 3**

**Match perennials with their correct propagation methods.** Write the correct letters in the blanks. Answers may be used more than once.

____1. Corms

____2. Tubers

____3. Rhizomes

____4. Tubular roots

____5. Bulbs

a. Division at the eyes

b. Separation

c. Division at the stem

d. Separation at the nodes

e. Division between nodes

f. Division of root sections

g. Division

h. Separation of nodes from stem

**OBJECTIVE 4**

**Describe four uses of garden flowers.**

**OBJECTIVE 5**

**Select from the following list considerations for planting a flower bed or border.** Write an "X" in the blank before each correct statement.

___ 1. The flower bed should contain a wide range of varieties suited for several soil types.

___ 2. Plant width determines where a plant is placed in the bed.

___ 3. Know the time of blooming and select varieties that will maintain a continuous show of color throughout the season.

___ 4. The background determines plant spacing.

___ 5. Contrasting colors help create a visual focus.

___ 6. Know the soil type and moisture level of the bed and select contrasting plants that will thrive in those conditions.

___ 7. Small plants are preferred for borders around buildings and along fencelines.

___ 8. Color scheme should create an overall aesthetic effect.

___ 9. Select varieties according to the available light in the garden area.

___ 10. How the time of blooming and select varieties that will insure a balance of annuals and perennials.

___ 11. Width of plants determines their spacing.

___ 12. Tall plants are placed at the rear or center, medium-height plants in the middle and short plants at the edges.

___ 13. The flower bed should feature primarily mid-summer blooming species.

___ 14. Color variety adds interest and creates a pleasing visual effect.

___ 15. Border plantings should compliment the background.

___ 16. Know the soil type and moisture level of the bed and select compatible plants that will thrive in those conditions.

| | |
|---|---|
| **OBJECTIVE 6** | **State general soil type and pH range for garden soils.** |
| | 1. A good garden soil ____________________________<br>________________________________________ |
| | 2. pH for most garden flowers is ____________________ |
| **OBJECTIVE 7** | **Describe light exposure requirements and characteristics of ten species of annuals.** Fill in the chart on the following page. |

**Annuals**

| Name | Light Exposure | Uses | Height (In.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Annuals**

| Name | Light Exposure | Uses | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## OBJECTIVE 8

**Describe light exposure requirements and characteristics of two species of biennials. Fill in the chart below.**

**Biennials**

| Name | Light Exposure | Uses | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**OBJECTIVE 9** Describe light exposure requirements and characteristics of ten species of flowering perennials. Fill in the chart below.

## Perennials

| Name | Light Exposure | Uses | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Perennials**

| Name | Light Exposure | Uses | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**OBJECTIVE 10**

**Describe light exposure requirements and characteristics of five species of ground cover and vines. Fill in the chart below.**

**Ground covers and vines**

| Name | Light Exposure | Uses | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

## OBJECTIVE 11

**Describe light exposure, soil and moisture requirements for three species of bulbs. Fill in the chart below.**

**Bulb species**

| Name | Light Exposure | Uses | Spacing (in.) | Height (in.) | Flower Colors | Time of Bloom |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**NOTICE** The following assignment sheets and job sheets are not a part of the written test. If these activities have not been completed, check with your instructor.

**OBJECTIVE 12** **Select compatible varieties of flowers to be planted in full sun and partial shade.** SCORE ________

**OBJECTIVE 13** **Plan a garden or border using varieties of annuals, biennals and perennials.** SCORE ________

**OBJECTIVE 14** **Demonstrate the ability to**

**a. Prepare a soil bed.** RATING _______

**b. Grow flowering annuals from seed.** RATING _______

**c. Care for plants after planting.** RATING _______

**WRITTEN TEST ANSWERS**

## INTRODUCTION TO GARDEN FLOWERS

## XXI

### OBJECTIVE 1

1. c
2. f
3. l
4. i
5. m
6. d
7. j
8. b
9. k

### OBJECTIVE 2

1. c
2. d
3. e
4. a
5. b

### OBJECTIVE 3

1. b
2. a
3. e
4. f
5. b

### OBJECTIVE 4

Students may select any four of the following

- Edging—Low-growing flowers or ground cover placed along the outer borders of the planting bed
- Cut flowers—Bouquets and floral arrangements
- Potted plant—Grown in containers and tubs for interior decoration
- Hanging basket—Flowers placed for color at eye level
- Mass plantings—Flower beds, island beds and borders

| | |
|---|---|
| **OBJECTIVE 5** | 3, 5, 8, 9, 11, 12, 14, 15, 16 |
| **OBJECTIVE 6** | 1. Should have a good water-holding capacity and good drainage<br>2. 6.0-7.5 |
| **OBJECTIVE 7** | Answers should include accurate information from Table 1. |
| **OBJECTIVE 8** | Answers should include accurate information from Table 2. |
| **OBJECTIVE 9** | Answers should include accurate information from Table 3. |
| **OBJECTIVE 10** | Answers should include accurate information from Table 4. |
| **OBJECTIVE 11** | Answers should include accurate information from Table 5. |
| **OBJECTIVE 12** | Refer to answers to Assignment Sheet 1. |
| **OJECTIVE 13** | Refer to answers to Assignment Sheet 2. |
| **OBJECTIVE 14** | Refer to Practical Tests for Job Sheets 1 through 3. |